



AGRICULTURAL RESEARCH INSTITUTE'
PUSA

BULLETIN

OF THE
DEPARTMENT OF AGRICULTURE,
Trinidad and Tobago.

VOL. XIII.]

JANUARY, 1914.

[No. 77.]

COCONUTS.

MANURIAL EXPERIMENTS ON COCONUTS 1912-13.

BY JOSEPH DE VERTEUIL, F.C.S.,
Superintendent of Field Experiments.

This report deals with the second year's results of the manurial experiments on coconuts, under the control of the Board of Agriculture and is in continuation of the report for 1911-12 (*Bulletin, Department of Agriculture*. XI. 1912. pp. 179-184).

The dry season of 1912 was very severe and although the number of nuts picked from the plots on the Morvant estate, Laventille and the King's Bay estate, Tobago, does not show a marked decrease, it will be observed that a smaller proportion of "selects" has been obtained than during the previous year. On the Beaulieu estate at Cedros, the crop has been considerably affected and the proportion of selects has been reduced by nearly 50 per cent.

Mention was made in the previous report that the yield for the first year may be considered as a "natural yield" for each plot, owing to the fact that the manures had only been applied shortly before. This year's yield may therefore be compared with that obtained from the corresponding plots last year, but no conclusions should be drawn from the results of a single year.

The figures obtained are given in tables I to VI for each estate respectively. In these tables the heading "value of probable increase or decrease due to manuring" may require some explanation. The probable increase or decrease due to manuring is the increase or decrease of the manured plots to which is added or deducted the decrease or increase shown by the average of the control plots. When the control plots show an increase it is probable that the manured plots show a larger increase than what is actually due to manuring and the natural increase indicated by the control plots must be deducted to arrive at correct results. The writer is perfectly aware that all the plots will not, under natural conditions, show the same increase or decrease each year, but if the average be taken over a series of years the error will be greatly reduced.

"Decrease due to manuring" means that the cost of the manures and of their application is greater than the value of the increased yield obtained.

In calculating the yield and cost of manuring per acre, it has been assumed that there are 75 trees to the acre, as the trees are planted 24 feet apart. The price of "selects" has been fixed at \$25.00 and that of "culls" at \$15.00 per 1,000, which is considered a fair average price; of course the higher the price the greater will be the profits shown for the increased yield and *vice versa*.

MORVANT ESTATE—LAVENTILLE.

The second application of manures was made in May 1912.

Rainfall ... { 1911-12 = 39.12 in.
1912-13 = 41.27 in.

TABLE I.—MANURIAL EXPERIMENTS, MORVANT ESTATE.

Trees about 26 years old.

Plot.	No. of bearing trees.	Manures applied per tree.	Crop, July 1. to June 30.	Average number of nuts picked per tree.	Per cent. Selects.	PER ACRE.					
						Selects.	Culls.	Value of increase or decrease on crop 1911-12.	Value of probable increase or decrease due to manuring.	Cost of manuring.	Profit or loss on no manure.
								% c.	% c.	% c.	% c.
1	68	4 lb. Lime ...	1911-12	20.3	58.9	899	627				
		4 „ Kainit ...	1912-13	36.7	61.5	1,691	1,060	26.29	7.37	9.51	3.30
2	69	6 lb. Basic slag	1911-12	38.9	63.7	1,859	1,057				
		1 „ Sulphate of potash	1912-13	47.5	63.5	2,262	1,298	13.69	5.23	11.29	11.08
3	70	Control -- No manure	1911-12	40.7	58.5	1,789	1,266				
			1912-13	53.1	48.6	1,936	2,048	15.40	..	*5.44	..
4	70	4 lb. Basic slag	1911-12	35.1	65.2	1,717	918				
		2 „ Nitrate of soda	1912-13	47.0	60.3	2,126	1,400	17.45	1.47	11.64	7.67
5	70	2 lb. Calciumcyanamide	1911-12	43.8	61.1	2,007	1,277				
		2 „ Sulphate of potash	1912-13	58.5	64.8	2,845	1,545	24.97	6.05	13.79	2.30
6	70	Control -- No manure	1911-12	25.9	64.9	1,262	682				
			1912-13	39.4	66.5	1,967	990	22.44	...	*5.44	..
7	70	2 lb. Bone meal	1911-12	41.0	60.8	1,873	1,206				
		1 „ Sulph. of potash 150 „ Pen manure	1912-13	55.7	60.6	2,533	1,643	23.05	4.13	17.60	8.03
8	67	2 lb Superphos. of lime	1911-12	31.1	61.9	1,444	888				
		1 „ Sulphate of potash 150 „ Pen manure	1912-13	37.2	63.0	1,757	1,031	9.97	8.95	17.25	20.76
		Average--Control plots						18.92	..	*5.44	..

All the plots have given an increased yield over the previous year, but the increase from plots 1, 5 and 7 is greater than that of the control plots. From a pecuniary point of view, plot 1 alone has given a profit.

* Cost of forking.

BEAULIEU ESTATE—CEDROS.

These experiments are being conducted in three series A, B and C as shown in tables II to IV. The average results obtained for the three series is given in table V.

The manures were applied in April, 1912.

Rainfall { 1911-1912 = 39.84 in.
1912-1913 = 55.76 in.

TABLE II.—MANURIAL EXPERIMENTS.—BEAULIEU ESTATE, CEDROS.—SERIES A.

Trees 31 to 36 years old.

Plot.	No. of bearing trees.	Manures applied per tree.	Crop July 1, to June 30.	Average number of nuts picked per tree.	Per cent. Selects.	PER ACRE.					
						Selects.	Culls.	Value of increase or decrease on crop 1911-12.	Value of probable increase or decrease due to manuring.	Cost of manuring.	Profit or loss on no manuring.
								\$ c.	\$ c.	c.	\$ c.
1	15	4 lb. Lime ...	1911-12	135.9	40.2	4,100	6,090				
		4 ,, Kainit ...	1912-13	73.5	23.2	1,278	4,232	-98 42	4 37	15 09	-1.88
2	17	6 lb. Basic slag	1911-12	107.4	58.3	4,697	3,356				
		1 ,, Sulphate of potash	1912-13	54.9	27.4	1,128	2,988	-94 74	8 05	16 46	0 43
3	12	Control — No manure.	1911-12	120.8	46.3	4,194	4,869				
			1912-13	76.2	21.9	1,252	4,467	-79 58	..	*8 84	...
4	14	4 lb. Basic slag	1911-12	135.1	58.2	5,898	4,232				
		2 ,, Nitrate of soda	1912-13	101.8	23.3	1,779	5,865	-78 68	24 11	16 59	16 36
5	15	2 lb. Calcium cyanamide	1911-12	138.9	45.6	4,757	5,662				
		2 ,, Sulphate of potash	1912-13	82.4	29.1	1,798	4,382	-93 17	9 62	19 09	-0 63
6	14	Control — No manure.	1911-12	146.8	65.6	7,227	3,782				
			1912-13	81.8	31.6	1,938	4,196	-126 01	...	*8 84	...
7	15	2 lb. Bone meal	1911 12	126.4	54.8	5,195	4,285				
		1 ,, Sulp. of ammonia	1912-13	70.1	27.0	1,420	3,840	-101 05	1 74	29 48	-18 90
8	15	150 ,, Pen manure	1911-12	125.3	59.4	5,580	3,820				
		2 lb. Superphosp. of lime	1912-13	85.5	34.2	2,192	4,218	-78 73	24 06	26 12	6 78
		Average—Control plots ...	...	...	...	...	...	-102 79	...	*8 84	...

* Cost of forking.

TABLE III.—MANURIAL EXPERIMENTS, BEAULIEU ESTATE, CEDROS.—SERIES B.

Trees 31 to 36 years old.

Plot.	No. of bearing trees.	Manures applied per tree.	Crop July 1, to June 30.	Average number of nuts picked per tree.	Per cent. Selects.	PER ACRE.					
						Selects	Culls.	Value of increase or decrease on crop 1911-1912.	Value of probable increase or decrease due to manuring.	Cost of manuring.	Profit or loss on no manure.
							\$ c.	% c.	\$ c.	% c.	\$ c.
1	19	{ 4 lb. Lime	1911-12	83.0	60.9	3,791	2,434				
		{ 4 „ Kainit	1912-13	76.2	34.9	1,993	3,719	-25 68	10 58	15 09	4 33
2	25	{ 6 lb. Basic slag	1911-12	70.0	78.1	4,102	1,148				
		{ 1 „ Sulphate of potash	1912-13	55.3	48.2	2,001	2,150	-37 51	-1 25	16 46	8 87
3	25	{ Control — No manure	1911-12	50.1	70.8	2,664	1,095				
		{	1912-13	34.4	40.2	1,037	1,544	-33 94	...	* 8 84	..
4	25	{ 4 lb. Basic slag	1911-12	54.9	67.7	2,789	1,330				
		{ 2 „ Nitrate of soda	1912-13	46.8	34.3	1,203	2,304	-25 04	11 22	16 59	3 47
5	25	{ 2 lb. Calcium cyanamide	1911-12	61.7	65.3	3,025	1,606				
		{ 2 „ Sulphate of potash	1912-13	45.5	36.5	1,246	2,168	-36 04	0 22	19 09	-10 03
6	22	{ Control — No manure	1911-12	65.2	51.1	2,501	2,393				
		{	1912-13	44.9	27.7	933	2,435	-38 59	...	* 8 84	...
7	24	{ 2 lb. Bone meal	1911-12	56.1	54.4	2,293	1,918				
		{ 1 „ Sulp. of ammonia	1912-13	42.4	26.1	829	2,349	-30 13	6 13	29 48	-14 51
8	26	{ 150 „ Pen manure									
		{ 2 lb. Superphos. of lime	1911-12	57.3	59.3	2,547	1,751				
		{ 1 „ Sulp. of potash	1912-13	59.9	21.6	971	3,523	-12 82	23 44	26 12	6 16
		{ 150 „ Pen manure									
		Average—Control plots	...	...	...	...	...	-36 26	...	* 8 84	...

Cost of forking.

TABLE IV.—MANURIAL EXPERIMENTS.—BEAULIEU ESTATE, CEDROS.—SERIES C.

Trees 31 to 36 years old.

Plot.	No. of bearing trees.	Manures applied per tree.	Crop July 1, to June 30.	Average number of nuts picked per tree.	Per cent. Selects.	PER ACRE.					Profit or loss on no manure.
						Selects.	Culls.	Value of increase or decrease on crop 1911-12.	Value of probable increase or decrease due to manuring.	Cost of manuring.	
								\$ c.	\$ c.	\$ c.	\$ c.
1	26	4 lb. Lime ...	1911-12	55·8	55·9	2,339	1,846				
		4 „ Kainit ...	1912-13	44·5	28·3	944	2,393	-26 67	7 10	15 09	0 85
2	24	6 lb. Basic slag	1911-12	82·4	59·9	3,703	2,481				
		1 „ Sulphate of potash	1912-13	50·4	30·9	1,168	2,613	-61 39	-27 62	16 46	-35 24
3	25	Control — No manure	1911-12	59·0	57·1	525	1,900				
			1912-13	50·6	26·0	987	2,808	-24 83	...	* 8 84	...
4	24	4 lb. Basic slag	1911-12	63·9	49·8	2,390	2,406				
		2 „ Nitrate of soda	1912-13	58·0	24·1	1,048	3,302	-20 11	13 66	16 59	5 91
5	16	2 lb. Calcium cyanamide	1911-12	103·3	57·7	4,473	3,278				
		2 „ Sulphate of potash	1912-13	76·4	25·7	1,472	4,256	60 35	26 58	19 09	-36 83
6	18	Control — No manure	1911-12	77·6	54·1	3,154	2,670				
			1912-13	57·2	27·7	1,187	3,100	-42 72	...	* 8 84	...
7	18	2 lb. Bone meal	1911-12	101·9	49·4	3,775	3,871				
		1 „ Sulp. of ammonia	1912-13	67·6	20·2	1,024	4,047	-66 13	-32 36	29 48	-53 00
8	19	2 lb. Superph. of lime	1911-12	98·7	50·9	3,769	3,634				
		1 „ Sulphate of potash	1912-13	59·0	38·6	1,708	2,717	-65 28	-31 51	26 12	-48 79
		Average — Control plots	...	...	...	...	...	-33 77	...	* 8 84	...

*Cost of forking.

TABLE V.—MANURIAL EXPERIMENTS.—BEAULIEU ESTATE, CEDROS.

Average of Series A, B and C.

Plot.	Crop July 1, to June 30.	Average number of nuts picked per tree.	Per cent. Selects.	PER ACRE.					
				Selects.	Culls.	Value of increase or decrease on crop 1911-12.	Value of probable in- crease or decrease due to manuring.	Cost of manuring.	Profit or loss on no manure.
						\$ c.	\$ c.	\$ c.	\$
1 {	1911-12	84.4	49.6	3,410	3,457				
	1912-13	61.8	28.9	1,405	3,448	-50 26	7 09	15 09	0 84
2 {	1911-12	84.2	64.1	4,167	2,328				
	1912-13	53.5	35.6	1,432	2,584	-64 53	- 7 18	16 46	-11 80
3 {	1911-12	6.84	54.4	3,128	2,621				
	1912-13	48.2	27.1	1,092	2,940	-45 62	...	*8.84	...
4 {	1911-12	75.7	58.2	3,692	2,656				
	1912-13	63.3	26.0	1,343	3,820	-41 26	16 09	16 59	8 34
5 {	1911-12	94.2	53.7	4,085	3,515				
	1912-13	64.2	29.5	1,505	3,602	-63 19	- 5 84	19 09	-16 09
6 {	1911-12	89.6	59.3	4,294	2,948				
	1912-13	58.5	29.4	1,353	3,244	-69 08	...	*8.84	..
7 {	1911-12	88.0	52.8	3,754	3,358				
	1912-13	57.6	24.2	1,091	3,412	-65 76	- 8 41	29 48	-29 05
8 {	1911-12	86.2	56.4	3,965	3,068				
	1912-13	66.0	31.8	1,624	3,486	-52 25	5 10	26 12	-12 18
Average—Control plots ...				..	...	-57 35	..	*8.84	...

All the plots show a large decrease on the previous year, but the decrease from plots 1, 4 and 8 is less than the decrease from the average of the control plots. Plots 1 and 4 have given a profit after deducting the cost of manuring.

* Cost of forking.

KING'S BAY ESTATE, TOBAGO.

The second application of manures was made in March, 1912.

Rainfall { 1911-12 = 66.71 in.
1912-13 = 64.57 in.

TABLE VI.—MANURIAL EXPERIMENTS.—KING'S BAY ESTATE.

Trees 21 to 26 years old.

Plot.	No. of bearing trees.	Manures applied per tree.	Crop July 1. to June 30.	Average number of nuts picked per tree.	Per cent. Selects.	PER ACRE.					
						Selects.	Culls.	Value of increase or decrease on crop 1911-12.	Value of probable increase or decrease due to manuring.	Cost of manuring.	Profit or loss on no manure.
								% c.	% c.	% c.	% c.
1	46	4 lb. Lime ...	1911-12	74.4	70.1	3,911	1,671				
		4 „ Kainit...	1912-13	83.8	62.5	3,931	2,358	10.80	15.67	8.51	11.69
2	66	6 lb. Basic slag	1911-12	56.2	67.2	2,832	1,381				
		1 „ Sulphate of potash	1912-13	71.7	64.0	3,443	1,937	23.61	28.48	10.28	22.73
3	56	Control No manure	1911-12	60.3	68.0	3,076	1,444				
			1912-13	63.5	63.5	3,025	1,736	3.11	...	*4.51	...
4	82	4 lb. Basic slag	1911-12	51.1	69.1	2,650	1,184				
		2 „ Nitrate of soda	1912-13	58.5	61.7	2,706	1,678	8.81	13.68	10.64	7.57
5	70	2 lb. Calciumcyanamide	1911-12	67.6	67.0	3,394	1,674				
		2 „ Sulphate of potash	1912-13	79.6	56.2	3,355	2,616	13.16	18.03	12.91	9.65
6	80	Control No manure	1911-12	58.4	68.2	2,989	1,390				
			1912-13	56.2	57.8	2,438	1,776	-7.98	...	*4.56	..
7	65	2 lb. Bone meal	1911-12	54.1	68.7	2,791	1,269				
		1 „ Sulphate of ammonia	1912-13	72.7	59.8	3,263	2,190	25.61	30.48	9.66	25.35
8	76	2 lb. Superphos. of lime	1911-12	60.4	67.1	3,041	1,492				
		1 „ Sulphate of potash	1912-13	77.6	66.8	3,888	1,933	27.79	32.66	9.21	27.98
		Average—Control plots	...	...	...	...	...	-4.87	...	*4.53	...

With the exception of control plot 6, there has been a slight increase in the number of nuts obtained per tree from all the plots as compared with the previous twelve months. There has been a decrease in the proportion of selects varying from 0.8 to 10.8 per cent. On this estate all the manured plots have given a larger increase than the average of the control plots and the pecuniary results are satisfactory.

* Cost of forking.

CACAO.

VISIT TO CACAO ESTATES IN TOBAGO.

ARRANGEMENTS were made for a visit to cacao estates in Tobago by Mr. J. C. Augustus, Curator of the Botanical Department, Trinidad, and Superintendent (formerly Manager) of the Government Cacao Estate at River, under the control of the Department. The following is taken from his report on his visit :—

The length of my visit was unavoidably curtailed owing to unexpected changes in the steamer's movements and instead of having a two weeks' stay in the island as was intended I had but seven days, arriving at King's Bay on December 12, and returning from Scarborough on December 20.

During this short period however, I was able, owing to the kind assistance of all the planters I had the pleasure of meeting, to see a fair portion of the windward side of the island and the following estates were visited :—

King's Bay Estate, Mr. R. S. Reid ; Merchiston Estate, Mr. Thomas ; Speyside Estate, Mr. Tucker ; Louis D'or Estate, Mr. Orde ; Roxborough Estate, Mr. Archibald ; Kendal & Florida, Mr. Murray ; Richmond Estate, Capt. Short ; Studley Park Estate, Mr. Alefounder ; Green Hill Estate, Mr. Hamilton ; Trafalgar Estate, Mr. Sworder ; Cocowatee Estate, Hon. H. L. Thornton.

Letters were received from the following :—

Messrs. Tucker of Lure Estate ; Macgillivray, Franklyn Estate ; Dunlop Smith, Les Coteaux Estate ; Corder, Perseverance Estate ; and Aubrey Murray asking me to visit and advise them on various matters, but unfortunately the time at my disposal was insufficient.

At each of the estates visited I made a short stay discussing and advising on various matters in which my assistance was sought and at each of the places gave budding demonstrations in which a great deal of interest was taken, several of the proprietors promising to give the matter every attention.

From the little I have been able to see there can be no doubt that Tobago is forging ahead fast and bids fair in the not too distant future of holding an enviable position as a cacao and coconut producing centre.

Many of the estates visited compare very favourably with the best kept Trinidad estates and are run on distinctly modern lines.

There can be no doubt that the island offers exceptional opportunities for the man with some capital ; there are lots of abandoned sugar lands yet to be taken up and there is no reason why these might not also be turned in the course of time into remunerative cacao and coconut plantations.

A striking characteristic of Tobago is that they are alive to the sound maxim of not placing all their eggs in one basket and so one finds that almost every estate boasts of two crops, viz. cacao and coconuts, grown independently of each other, and on some a third, rubber (though this latter is now generally condemned when forming a mixed cultivation with cacao.

In addition many planters are now wisely contemplating the growing of limes on lands considered not so suitable for either cacao or coconuts and I am of opinion that the conditions on the estates visited are admirably suited to the growth of such a crop and feel confident that if similar energy and zeal is devoted to limes as to cacao they will prove a sound investment.

On the whole this, my first visit to the island, has been an exceedingly interesting one. Everywhere I was courteously welcomed, my advice eagerly sought, and the hope expressed that I would return again for a longer period; my thanks are due to all the planters for the kind hospitality and unfailing assistance so readily given me without which I would certainly not have been able to obtain, in so short a period, as fair an insight into the local conditions and the various agricultural activities of the island.

J. C. A.

Cacao Beetles and Thrips.--In connection with these pests the Entomologist reported to the December meeting of the Board of Agriculture as follows:—Since the last meeting of the Board the rainy weather has hampered the work of spraying in connection with cacao beetles at Erin and Moruga. It was not possible to spray as planned, but as soon as the weather is more settled the operations will be resumed. Adults and larvæ of the cacao beetle are still being caught in different parts of the island. In connection with thrips I have observed that there is a tendency to increase on the pods and on some of the leaves. The numbers present are not capable of doing any damage to the trees, but the fact remains that in some localities they are present in sufficient numbers to warrant spraying. Cacao fields which had been sprayed with Bordeaux mixture for black rot are showing a small percentage of bad pods as compared with unsprayed fields. The present rainy season has shown up very well the advantage of spraying.

SUGAR.

THE FROGHOPPER EGG PARASITE (*Oligosita giraulti*,
CRAWFORD) **AND ITS COLONIZATION IN THE CANE
FIELDS.***

By F. W. URICH, F.E.S. C.M.Z.S.,
Entomologist to the Board of Agriculture.

IDENTIFICATION.

IN a recent letter Dr. L. O. Howard whom I desire to thank, informs me that Mr. J. C. Crawford had determined the vermilion frog hopper egg-parasite as *Oligosita giraulti*, Crawford.

DISTRIBUTION.

The parasite has been bred from grass from the following localities: Valley of the Arima River, Caura, Tamana, Chatham, Caroni and Esperanza sugar cane estates. Table I shows some of the localities from which grass was collected and the emergence of parasites from it.

TABLE I.—SHOWING EMERGENCE OF PARASITES FROM GRASS.

Locality.	Date put into tube cage.	No. and date of emergence of parasites.	Total parasites.	Remarks.	
Valley of the Arima River	Jan. 26	1—Jan. 30 1—Feb. 1 1— „ 3 1— „ 4 2— „ 14 1— „ 22	7	Weather fairly dry, localities damp on account of situation. With the exception of Tamana when a small quantity was used, about $\frac{1}{2}$ bag of grass was put in tube cages.	
„	February 8	7—Feb. 17 1— „ 18 3— „ 23 1— „ 27	12		
„	March 16	3—April 2 1— „ 4	4		
Tamana	April 17	1—May 4	1		
Chatham	„ 24	5—April 29 2— „ 30	7		
Esperanza estate, California	June 15	June 18 „ 19 „ 20	11 6 Numerous not counted		Grass taken from banks of a river running through cane-fields on section of estate that was not affected by frog-hoppers. Grass distributed in cane-field after the 20th June.

* Originally published as *Circular No. 11*, of the Board of Agriculture, Aug. 18, 1913.

LIFE HISTORY.

The parasite is extremely active and runs over dead cane and grass leaves very rapidly with a swaying movement, repeatedly turning about very suddenly and counter marching in very quick time. When on the move and in search of frog hopper eggs the antennæ are held bent downward in front of the head and appear to touch the surface of the leaf. Frog hopper eggs are located through the dry tissues and it is only after a thorough examination that oviposition begins. Several trials are made before the right spot is found on the frog hopper egg. Oviposition occupies a variable time according to the state of eggs and has occupied a period varying from four to thirty minutes. On one occasion 6 frog hopper eggs were pierced in one hour. Many eggs that are laid fail to hatch. In table II there will be found the results of experiments to determine the stage of development of the frog hopper egg that is most suitable for the development of the parasite. It appears to be the stage in which the embryo is well advanced and the hatching lid well formed and black.

TABLE II.—SHOWING RESULTS OF EXPERIMENTS WITH FROGHOPPER EGGS IN DIFFERENT STAGES OF DEVELOPMENT.

No. of Experiment.	State of egg when placed with parasites.	Period of oviposition by parasites.	Results.
2	Aestivating for six weeks	Feb. 4 to 7 ...	4 parasites issued also some frog hopper nymphs.
2-3	Development of embryo advanced hatching lid of frog hopper egg well formed	March 1 and 4	14 parasites issued also some frog hopper nymphs.
2-9	Ditto ...	... April 8 and 15	8 parasites issued also some frog hopper nymphs.
5	Newly laid	... April 1 to 7...	No result, frog hopper nymphs issued on May 8.
6	Ditto ...	... April 2 to 12...	No result, frog hopper nymphs issued on May 6.

Table III gives the results of the period of development of the parasites from the time the egg is laid to the emergence of the perfect insect. The results show that the larval and pupal stages of the parasite take from 22 to 41 days.

TABLE III.—SHOWING PERIOD OF DEVELOPMENT OF PARASITES.

No. of Experiment.	Period of oviposition.	Dates of emergence of parasites.
2	February 4 to 7	... February 25. 28. March 1.
2-3	March 1 to 4	... .. 23. .. 30. .. 31.
2-3	March 1 to 4	... April 1. .. 2. .. 6. .. 8. .. 11. .. 13.
3	February 18 to 20	... March 15. .. 19. .. 22. .. 23.

A normal frog hopper egg remains white during the development of the embryo of the nymph, but when parasitized it changes colour after 5-7 days first turning grey and then quite black, the intensity of the dark colour however varies and some eggs appear at times less opaque than others. In such eggs the red colouration of the parasite can be made out a day or two before emergence, by viewing the egg by transmitted light. When a parasite is about to issue, the frog hopper egg appears lighter in colour at one end, the shell gets thinner and after a time the little mandibles of the parasite break through and can be seen hard at work eating a hole large enough to let it gain its liberty. The process of emergence occupies about 2 hours. When the parasite issues from the frog hopper egg it looks damp, the delicate wings reach only to the middle of the abdomen, but they soon expand to full length, the lower ones attaining full size first. After coming out of the frog hopper egg the parasite remains quiet on the top of it for about five minutes after which a very thorough cleaning and brushing process begins, during which legs and mandibles are freely made use of to try and brush down wings and body. About ten minutes after emerging the parasite walks away. Oviposition in frog hopper eggs generally begins about an hour after issuing from a frog hopper egg. So far no males have been observed.

HABITS OF THE ADULTS.

The adult parasite which measures about 0.50 mm. is a most active little creature and does not appear to rest much during the day. It is forever on the go searching for frog hopper eggs and passes from one piece of grass to another by little leaps. When given its liberty it soon disappears and no doubt can make good use of its wings. In Nature it appears to keep low down among the grass and I have not been able to collect any specimens by sweeping. In confinement it partakes readily of thin sugar and water and when properly fed remains alive from 12 to 26 days. Individuals that were not fed died after 2-3 days.

MULTIPLICATION.

The multiplication of the parasite is by no means as numerous as that of the frog hopper.

Progeny of a single female which reproduced parthenogenetically in confinement :—

Date of emergence from frog hopper egg	February 4.
„ of death of parasite ...	... February 7.
I. Generation issuing from Feb. 23 to March 1 produced	4 females.
II. „ „ March 13 to March 23 „	14 „
III. „ „ April 28 to May 14 „	6 „
Total ...	24

The third generation would no doubt have been more numerous if suitable frog hopper eggs had been available.

In comparing the periods of development of the parasite and the incubation of the egg of the frog hopper, the parasite has an advantage over the frog hopper inasmuch as the eggs of the frog hopper require more moisture to hatch than the parasite requires for its development. This is a factor greatly to the advantage of the parasite which means that two generations of parasites are able to attack the same batch of eggs. It happened in one of my breeding tubes that the same lot of frog hopper eggs were attacked twice by parasites at intervals of 23 days.

Another important factor is that the parasite reproduces parthenogenetically and a female is ready to lay one hour after issuing from a frog hopper egg. Table IV shows the result of this kind of reproduction.

TABLE IV.—SHOWING RESULT OF PARTHENOGENETIC REPRODUCTION OF PARASITE.

No. of Experiment.	Experiment.	Behaviour of Parasite.	Results.
2—1	Parasite reared from egg of frog hopper in tube.	Insect oviposited in frog hopper eggs proving itself a female between Feb. 25th and March 3rd.	On April 14, one adult parasite issued.
2—2	Ditto.	Insect oviposited in frog hopper eggs between Feb. 28th and March 9th.	Between April 20 and 25, two parasites issued.
2 3	2 parasites reared from eggs of frog hopper in tube.	Both insects proved themselves to be females and were observed ovipositing between March 1 and 4.	Between March 23 and April 13, fourteen parasites issued.
2—9	1 parasite reared from egg of frog hopper in tube.	Insect oviposited between April 8 and 15.	Between April 28 & May 18, eight parasites issued.

PERCENTAGE OF PARASITISM.

On account of the artificial conditions under which the parasites were reared it is difficult to estimate the number of eggs that a female would lay in Nature and under perfectly normal conditions. The maximum number of eggs laid in confinement which produced parasites amounted in the case of one female to eight and in another case to 14 for 2 females. Assuming that the froghopper laid on an average 50 eggs we get a parasitism of 16 per cent. which under normal conditions may rise to 25 per cent.

COLONISING THE PARASITES IN THE CANE FIELDS.

In Circular No. 7 I mentioned that adult parasites should be liberated in the cane fields after having been bred out in the tube cages, but this plan appears rather slow and it would better to first find out the distribution of parasites on each estate and then transfer grass yielding parasites by the cart load to fields that are known not to harbour any. Should no parasites be found on a sugar estate, then grass can be collected from one of the localities of the Northern Range. So far no hyperparasites have been observed. In the cool and grassy districts away from cane estates, the froghopper appears to be controlled to a great extent by the parasite during the dry season. Let us hope that the wet season will not make any material change and that we may be able to colonise it on the sugar cane estates either in special grass fields or in cane fields proper.

ADDITIONAL NOTE.

Since Circular No. 11 was published a search was made for parasites on Esperanza Estate. By using the tube cages described in Circular No. 7 (Board of Agriculture) parasites were found in 9 fields with a total area of 116 acres. In these fields there has never been any blight, although froghoppers were not entirely absent. By way of an experiment 15 cart loads of grass were taken from above fields and scattered in two fields (area 22 acres) in which no parasites could be found, but in which froghoppers were numerous. The grass containing parasites was applied in July, 1912 and during November parasites were recovered from grass and cane trash.

These fields were blighted in 1912.

January 26, 1914.

F.W.U.

Froghoppers.—At the December meeting of the Board of Agriculture the Entomologist, Mr. F. W. Urich reported in connection with the colonization in the cane fields of the vermilion froghopper egg parasite, that the parasite have recently been recovered from fields in which they were liberated in July.

With regard to Green Muscardine fungus, it may be of interest to know that it is used in Samoa with success in controlling the larvæ of the Rhinoceros beetle, one of the worst pests of the coconut palm there.

AGRICULTURAL BANKS.

WORKING OF A CO-OPERATIVE CREDIT SOCIETY.

IN discussing Agricultural Banks it is desirable to be able to refer to definite instances of banks worked on the co-operative system amongst small proprietors and others in tropical countries. The following account* taken from the *Tropical Agriculturist* for February, 1913, of the operations of such a bank carried on with the assistance of the Agricultural Society amongst village agriculturists in Ceylon will it is hoped prove of interest:

When the Dumbara Agricultural Society was formed in the early part of the year 1906, with the purpose of improving the condition of the village cultivator, representations were made to the Society that their efforts should be directed to extricate him from the clutches of the usurer if any attempt was to be made to improve his condition. The village money lender was a long established institution in the district, and his policy was to ingratiate himself into the confidence of the *goiyya* by making him loans and ultimately become the owner of the *goiyya's* lands. The rates of interest charged by the money lender on loans of seed paddy ranged from 30 to 100 per cent. for the period of six months. The remoter the village and poorer the villager the higher was the rate of interest recovered. Instances were brought to light that in certain villages the person who borrowed a bushel of paddy had to return two bushels at the end of six months, and if he failed to do so he had to supply four bushels at the end of the year, interest and compound interest working at the rate of 300 per cent. per annum. Cultivators of tobacco, too, had often to seek the aid of the money lender, who was generally the supplier of provisions. The rates of interest in such cases ranged from 24 to 45 per cent. on mortgages, and 30 to 60 per cent. on promissory notes. When the cultivator submitted the necessary document, he seldom received the whole amount at once. The amount agreed to be lent was paid weekly in provisions, and the money lender not only recovered the stipulated interest on the whole amount, but also made a profit on the provisions supplied.

Such being the state of affairs, the Society at once set about to discover a means of relieving the helpless cultivator. The matter was discussed at more than one meeting of the Society, and it was decided to establish a Co-operative Credit Society in connection with the Agricultural Society for the purpose of lending seed paddy and money at low rates of interest. It was at first intended to start small Credit Societies in several villages, and make the villagers themselves responsible for the recovery of loans, while the Dumbara Agricultural Society acted as an agricultural bank. But this was found unworkable owing to the ignorance of the villagers and their inability to conduct business by themselves.

The ways and means to raise the necessary capital were next discussed: whether funds should be got by issuing shares, receiving deposits, or by borrowing the required amount on the collective credit of the members. The first suggestion was given up as it appeared to partake of the nature of a Joint Stock Company, and the last one was

* Paper by C. Rasnayagam Mudaliyar, read before the Ceylon Agricultural Society at its Quarterly Meeting on February 3, 1913.

discarded as no one could be found who was willing to lend on sufficiently accommodating terms. It was therefore decided to raise the necessary capital by receiving deposits at 4 per cent. interest from the members of the local Agricultural Society.

Rules were framed to suit the decision arrived at, and on August 30, 1906, a sum of Rs. 420* was received from 22 members as their first deposits. Only a few intelligent members and some head men joined the society then and deposited money solely for the benefit of the cultivators, while the villagers who joined did so with a view of raising loans. The difficulties in the formation of such village banks through a combination of the cultivators themselves are three:—(1.) They are lacking in confidence, and are unwilling to entrust their money to anybody, particularly in promoting what they look upon as a venture; (2) if they have any money to lend, they would rather give it to their friends or dependents over whom they possess influence, with the prospect of getting better interest than the bank could give; (3) the really needy man who would benefit most by such a society has no money to deposit.

With the first deposits in hand the urgent relief of lending seed paddy was started in Uda Dumbara, where the lowest rate of interest usually charged was 50 per cent. for six months. The society entrusted 50 bushels of seed paddy to a sub-committee, with instructions to lend out small quantities to the most needy villagers, and all the 50 bushels were disbursed for the maha season of 1906 among 42 persons, all of whom returned the paddy borrowed at the next crop with 24 per cent. interest. The interest charged though high was the rate fixed by the villagers themselves and was readily paid. Very little paddy was borrowed during the yala harvest. In 1908 another paddy store was opened at Mediawaka with 80 bushels of paddy.

In 1906 loans were made to 42 persons amounting to 50 bushels.			
In 1907	53	76½	„
In 1908	50	95½	„
In 1909	87	131½	„
In 1910	101	141	„
In 1911	111	167½	„

During the six years the society has been at work in Uda Dumbara 662 bushels of paddy were lent to 444 persons, and out of this number 16 (3·6 per cent.) persons (representing 28 bushels) were defaulters last year. It is alleged that the borrowers had made other use of the paddy than for the purpose to which it was lent, and hence their inability to pay, but there are no grounds for this suspicion, and it is hoped that with the help of the Ratenahatmaya, this paddy, too, will be recovered at the next crop. Paddy should be lent only to persons who are well known to the sub-committees, and the borrowers made to understand that it is to their advantage to be honest. The members of the sub-committees have up-to-date given their services free to the Society. The successful working of this branch of the society is due to the active interest taken by Appuhamy, Registrar of Valaguna and Pihillegedera Tikiri Banda, Vel-muladeniya of Mediawaka, who are in charge of the

stores, and have done the work without any remuneration. As a result of the society's operation through these paddy stores, the professional lenders of seed paddy have reduced their rate of interest from 5 to 3 lahass per bushel (*i.e.* about 40 per cent.)

In August, 1906, there were 22 depositors with a deposit of Rs. 420; since then the increase has been as follows:—

On December 31, 1906,	there were	37 members	with Rs. 670 deposit.
„	1907.	„ 42	„ 740 „
„	1908.	„ 49	„ 790 „
„	1909.	„ 64	„ 1,000 „
„	1910.	„ 65	„ 1,010 „
„	1911.	„ 71	„ 1,070 „
On October 31, 1912.	„ 76	„ 1,130 „	

From the above statement it will be seen that the membership and the amount of deposits have been steadily increasing. Most of the new depositors have been villagers, who are only now beginning to realise the benefits they can derive from the society, and now know that their fears as to its being an instrument of taxation is an illusion. The society's chief aim being to teach the villager the benefits of co-operation, it has always endeavoured to encourage village depositors, so that loans may be covered by their security. Money being lent on purely personal security, the knowledge that every member has of his neighbour, coupled with the social influence he can wield over him is the greatest security. It is therefore, necessary that the society should have on its register as many members as possible within the area in which it operates; but as soon as there is a number belonging to a particular locality who are willing to accept joint responsibility, it is deemed advisable to separate them, and form them into a branch society, with power to borrow, and lend to their neighbours. Now that the village population have become acquainted with the benefits of a Co-operative Credit Society and learnt the value of mutual responsibility, it is almost time that the Dumbura organization began to throw out branches in the villages, so as to encourage the people themselves to manage their own affairs.

Cash loans made during the last six years have been as follows:—

In 1907	loans were made to	11 persons	amounting to	Rs. 550
In 1908	„	15	„ „	725
In 1909	„	19	„ „	950
In 1910	„	20	„ „	910
In 1911	„	20	„ „	950
In 1912	„	20	„ „	980

During these six years loans to the aggregate extent of Rs. 5065 were made to 105 persons and most of them have been recovered. One loan made to a headman in 1908 and two loans in 1909 and one in 1910 on the security of a headman have not yet been recovered. Of the loans made before the present year, four persons were given time to pay after the next harvest. The Society has found that the system of making loans on the security of a headman has not been satisfactory. The unsophisticated villager is, as a rule, a very honest individual.

Encouraged by these results, and fired by zeal and enthusiasm, the Society in 1911 undertook the stupendous task of improving the cultivation and curing of tobacco. It engaged the services of a tobacco expert

and secured the necessary capital by raising a loan, and launched on an enterprise the magnitude of which only became apparent to them by degrees. The expert who had been for twenty years a tobacco planter in Java unfortunately set about his work without due consideration of local conditions. On this account, and also owing to the want of proper seed, expert labour, and favourable weather conditions, the first crop was a failure. The expert then turned his attention in another direction, and has since succeeded in curing the locally-grown tobacco so as to make it suitable for the manufacture of an improved type of cigar and also of a quality of leaf which is likely to find favour in Europe. Although the Society through its enterprise has been the means of discovering a better system of cultivation, drying, fermentation, and curing, all of which hold out better prospects, it has also discovered that the experiments will have to be carried on for several years, and at considerable cost, before an improved trade in tobacco is established, and that this is quite beyond the Society. In fact, at the present moment it finds itself in a position which neither allows of its carrying on the tobacco work to a successful termination without financial assistance from outside, nor of its paying back the loan it raised and of abandoning the project. It is evident now that the Society has been too ambitious in venturing upon an enterprise which is entirely beyond its resources.

The successful working of this Society has mainly depended on three causes:—(1) The interest taken by the several Government Agents of the Central Province in the operation of the Society; (2) the influence exerted by Dunuwila Disava and Paranagama Ratemahatmaya, the two most influential chiefs of the district, and the three Ratemahatmayas who successfully presided over Uda Dumbara; (3) the enthusiasm displayed by some of the individual members, who all along believed in the benefits of co-operative credit to the *goiyya*.

I have in this short sketch endeavoured to trace the progress of the co-operative credit Society of Dumbara during the last ten years; how by patience and perseverance it overcame the conservatism of the village cultivator, and without any extraneous aid surmounted the difficulties it had to encounter. I trust that the new societies which are now being formed in different parts of the island will, benefiting by our experience, have a large measure of success. A society encouraged by the Government Agent or the Assistant Government Agent, supported in every way by the chief of the district and worked by a few enthusiastic workers, is bound to succeed. On the other hand, if any of the three above mentioned conditions is wanting, the society will have but a precarious existence.

THE DISCUSSION.

Dr. Fernando drew the attention of the danger of Co-operative Credit Societies undertaking work for which they are not intended as illustrated by the disaster which followed upon the tobacco experiments of the Dumbara Society.

Mr. Lyne concluded the debate by referring to the visit of Sir Rider Haggard who had made a special study of the Co-operative System in Denmark, and described his impressions in his book "Rural Denmark and its Lessons."

Sir Rider's views might be summed up in his dedication: "This book is dedicated to the farmers of Denmark in token of the admiration of a foreign agriculturist for the wisdom and brotherly understanding that have enabled them to triumph over the difficulties of soil, climate, and low prices, and, by the practice of general co-operation, to achieve individual and national success;" and his motto:—

"Get wisdom, get understanding ;

Yea, with all thou has gotten get understanding."

In Ceylon, the difficulty really was that the people did not as yet understand the principle of Co-operative Credit Societies.

ST. VINCENT AGRICULTURAL CREDIT SOCIETIES ORDINANCE.

Amendments.

SOME alterations have been found necessary in the Rules of the St. Vincent Agricultural Credit Societies which were given in this *Bulletin* XII pp, 179-88.

RULE V.—The following words have been added at the end of Sub-section (d):—

"If a member dies intestate without any legal representative and no person has obtained letters of administration within a reasonable time the Trustees shall have power to apply for letters of administration as an ordinary creditor would be entitled to do."

RULE VI.—This has been amended to provide for the payment of the Secretary.

"The members will also fix at each Annual General Meeting, by resolution the rate at which the Secretary may be remunerated and when necessary the amount to be levied on each member in respect to such remuneration."

RULE VII.—In place of the words printed in italics (see Vol. XII, p. 181) the following:—

"No member of Committee or any Office bearer except the Secretary, shall receive salary or any other remuneration under any conditions whatever."

RULE X.—The following paragraph has been added:—

"The Secretary may be remunerated at a rate to be determined by the members at a general meeting. The funds for payment of such remuneration may if necessary with the consent of a general meeting be obtained by equal levy on all the members of the Society."

FORM VI.—The appended Form VI being a form of Bond to be used for the Treasurer, Trustees and Secretary of a Society, shall be added to Schedule II of the Rules.

FORM VI.

SAINT VINCENT.

Know all men by these presents that We of of the Agricultural Credit Society, established in accordance with the provisions of the Agricultural Credit Societies Ordinance 1913 at in the Parish of in the Island of and of (as surety on behalf of the said) are jointly and severally held and firmly bound to the present Administrator of this Colony, his successors and assigns, in the sum of to be paid to the said as such Administrator for the time being, or to his successor for the time being, or to his certain attorney, for which payment, well and truly to be made, we jointly and severally bind ourselves and each of us by himself, our and each of our heirs, executors, and administrators, firmly by these presents, sealed with our seals.

Dated the day of in the year of our Lord one thousand nine hundred and

Whereas the above-bounden hath been duly appointed of the said Society established as aforesaid, and he, together with the above-bounden as his surety, have entered into the above-written Bond subject to the conditions hereinafter contained. Now, therefore, the condition of the above-written Bond is such that if the said shall and do justly and faithfully execute his office of of the said Society established as aforesaid, and shall and do render a just and true account of all moneys received and paid by him, and shall and do pay over all the moneys remaining in his hands, and assign and transfer or deliver all securities and effects, books, papers, and property of or belonging to the said Society, in his hands or custody, to such person or persons as the said Society shall appoint, according to the rules of the said Society, together with the proper or legal receipts or vouchers for such payments and likewise shall and do in all respects well and truly and faithfully perform and fulfil his office of to the said Society, according to the rules thereof, then the above-written Bond shall be void and of none effect, otherwise shall be and remain in full force and virtue.

(Seal)

(Seal)

Signed sealed and delivered by the above-named in the presence of

.....
name.....
occupation.....
residence.....
name.....
occupation.....
residence

Signed sealed and delivered by the above-named in the presence of

.....
name.....
occupation.....
residence.....
name.....
occupation.....
residence

AGRICULTURAL CONGRESS.

INTERNATIONAL CONGRESS OF TROPICAL AGRICULTURE.

THE following notice relative to the third International Congress of Tropical Agriculture has been received, from Prof. W. R. Dunstan, C.M.G., F.R.S., President, and Mons. F. Heim, Secretary, of the Association scientifique internationale d'Agronomie coloniale et tropicale :—

The International Association for Tropical Agriculture (Association scientifique internationale d'Agronomie coloniale et tropicale) has decided to hold in London, in June, 1914, an International Congress, in which all countries interested in Tropical Agriculture and Forestry are invited to participate. The Association has requested the Committee of the British Section, whose headquarters are at the Imperial Institute, to make the necessary arrangements for the meeting, in co-operation with the Bureau of the International Association in Paris.

The Congress will be held at the Imperial Institute, South Kensington, London, S.W. It will be opened on Tuesday, June 23, and close on Tuesday, June 30, 1914.

In the order of business at the meeting, the morning sittings (10 a.m. to 1 p.m.) will be reserved for papers and discussions on subjects of general importance, each morning being devoted to a single subject; the afternoon sittings (3 to 5 p.m.) will be reserved for papers and discussions on special subjects.

Communications intended for the Congress may be made in English, French, German or Italian; but the general language of the Congress will be English.

The following subjects are suggested for papers and discussion at the morning meetings. Contributions on these and similar subjects are invited :—

- I. Technical Education and Research in Tropical Agriculture.
- II. Labour Organisation and Supply in Tropical Countries.
- III. Scientific Problems of Rubber Production.
- IV. Methods of developing Cotton Cultivation in new Countries.
- V. Problems of Fibre Production.
- VI. Agricultural Credit Banks.
- VII. Agriculture in Arid Regions.
- VIII. Problems in Tropical Hygiene and Preventive Medicine.

Papers for the afternoon meetings are invited on the following subjects :—

- I. Problems relating to Tropical Agriculture and Forestry.
- II. The Cultivation and Production of—

Rubber	Tea.
Cotton and Fibres.	Coconuts.
Cereals and other Foodstuffs	Other Agricultural Products.
Tobacco.	Forest Products.
- III. Plant Diseases and Pests affecting Tropical Agriculture.

Papers recommended for publication and Reports of Discussions will be published at the close of the Congress.

The subscription for membership of the Congress will be £1, entitling members to admission to all meetings and receptions and to receive the volume of printed papers and discussions, on publication. Those desiring to become members of the Congress are requested to fill in the enclosed form and return it to the Organising Secretaries for the Congress, as soon as conveniently possible, in order that their names and permanent addresses may be registered.

A General Programme, with the complete arrangements, will be forwarded to all registered members before the meeting.

Arrangements will be made for the accommodation of members of the Congress at suitable hotels.

Arrangements have been made by the Organisers of the International Rubber Exhibition and of the International Cotton, Fibres and Allied Industries Exhibition to hold these Exhibitions during the period of the Congress, at the Royal Agricultural Hall, Islington, London, N. Members of the Congress will receive free season tickets of admission to the Exhibitions; and special means of conveyance between the Imperial Institute and the Agricultural Hall will be provided.

The Organising Committee cordially invite all who take an interest in Tropical Agriculture and Forestry to attend the Congress and to make the contents of the present circular as widely known as possible.

All correspondence relating to the communication of papers and the arrangements for the Congress should be addressed to:—

The Organising Secretaries,

Third International Congress of Tropical Agriculture,
Imperial Institute, London, S.W.

The Government will transmit subscriptions from any persons who may wish to become members of the Conference, if sent to the Acting Director of Agriculture by February 28. Members of the Conference receive the printed volume of papers and discussions.

LIVE STOCK.

MAL DE CADERAS.

A South American Disease of Horses and Mules.

THE Government has received from the Government of British Guiana the following information with reference to a disease affecting horses and mules in British Guiana:—

The Veterinary Committee of the Board of Agriculture assisted in its deliberations by Dr. E. P. Minett, Assistant Government Bacteriologist, Mr. A. L. Farrant, F.R.C.S., and Mr. G. E. Bodkin, Government Economic Biologist, has decided that a disease at present and for some time back prevalent among mules and horses in certain districts of the County of Berbice which had been provisionally described in his reports by the Government Veterinary Surgeon as Cerebro-spinal meningitis, is not that disease and that judging from its characteristic symptoms and from a report by Dr. Minett on an Epidemiological survey and investigation made by him into the probable causes of the disease it is the South American equine disease *Mal de caderas*.

The practical symptoms noticed here are:—

(1.) Loss of condition and progressive anæmia with rapidly increasing weakness, at first with failing appetite but in later stages the appetite is good.

(2.) The temperature of the affected animal is febrile in the early stages of the disease, rising in acute cases to 105° F., but falling in later stages to normal (100·2—101° F.) and tending in chronic stages to become sub-normal (98—99° F.).

(3.) The earliest characteristic symptom is the setting in of paralysis in the hindquarters accompanied by dragging and characteristic crossing of the hind legs. The animal staggers and its hindquarters oscillate from side to side. In the stable it supports itself against a wall, but not infrequently in the open it falls down.

(4.) Albuminuria and Haematuria are noted in some cases, but not in all.

(5.) Eruptions may occur on the neck, shoulders and hind-quarters. Conjunctivitis and chemosis are often present.

(6.) The disease is a very fatal one; animals may live from three weeks to as long as five or six months after the setting in of the paralysis but comparatively few, if any, completely recover.

(7.) Animals that apparently recover from the disease are for a prolonged period so weak in the hind-quarters as to be useless for draw purposes.

(8.) Animals that have died from the disease show practically no abnormal *post mortem* conditions other than congestion.

"The accuracy of Dr. Minett's diagnosis of the disease has since been proved by him having found trypanosomes in very large numbers in the blood taken from affected animals during the earliest acute febrile stage, thus confirming observations made by Mr. Veterinary Surgeon A. L. Farrant, F.R.C.V.S. These causative organisms are absent from, or have not been found in, the blood of affected animals in later stages of the disease.

"*Mal de caderas* is confined to horses, mules and asses; it has not been known to attack cattle.

FRUIT.

EXPERIMENTAL SHIPMENT OF AVOCADO PEARS.

The Director of Agriculture took home on his visit to England in November two cases of avocado pears which were carefully packed by Mr. Arneaud de Boissière. Through the courtesy of Mr. Skinner they were stored in the vegetable chamber (the temperature of which is kept at 45° F.) during the voyage and they arrived in perfect condition. On examination during the voyage it was found that one was bruised but not ripe; this was removed.

They were exposed for sale in a London fruit shop, and the prices realized for the shipper were 12s. per dozen for three dozen and 10s. per dozen for two dozen. They presented a most attractive appearance contrasting strongly with another consignment from the Canary Islands.

The following report was received from the Manager of the fruit department:—

“The pears were very good and I would assure you that future consignments will receive our best attention.”

This experiment shows that avocado pears can be successfully shipped and sold at remunerative prices if stored at a temperature of 45° F.

Reference to this trial shipment was made on p. 168 (Vol. xii. No. 75) in the article on “Exporting Avocado Pears.”

Fruiting of the Mangosteen. In Government House Gardens there is a tree of the Mangosteen (*Garcinia Mangostana*) which has now borne fruit more or less regularly for several years. There are also a few other fruiting trees in the Colony *e.g.* at Arima in the grounds of Mr. J. G. de Gannes and at Monte Christo estate, the property of Mr. H. Monceaux.

In addition to the old tree in the Government House Gardens there is another which has not yet borne fruit, and a group at St. Clair Experiment Station. The latter are now 11 years old and this month (January, 1914) one of them bore a single fruit for the first time. The age of this tree is definitely known as they were planted personally by Mr. J. C. Augustus, now the Curator of the Gardens. It will be of interest to know from others who have trees of any definite records of the age at which they begin to bear fruit in the Colony.

BIRDS.

NOTES ON SOME BIRDS OF TRINIDAD AND TOBAGO.

BY G. ST. CLAIRE FEILDEN, B.A.

Mr. Feilden was a member of the Department of Agriculture from May, 1910 to October, 1911 during which time he acted successively as Assistant Superintendent and Curator of the Botanic Gardens, Trinidad, and as Curator of the Botanic Station, Tobago. He now holds a Government appointment in Egypt. Mr. Feilden, whilst in the Colony, took a keen interest in the birds of Trinidad and Tobago, and has, since he left, kindly contributed the following notes. (Ed.)

The Colony has a very rich avifauna of about 300 species. These notes deal with only a few of the more common birds.

TYRANNIDÆ OR TYRANTS.

A large and much varied group restricted entirely to the New World where they appear to take the place of the Flycatchers (*Muscicapidæ*) of the Old World. The majority have the bill much flattened and beset with hairs. Many have an orange or red crest, concealed when at rest under feathers of a duller hue.

The following Tyrants are among those found in the Colony:—

1. *Pitangus sulphuratus*. Linn. (*Saurophagus sulphuratus*. Leot.)
Qu'est-ce-qu'il-dit:—Length 10 inches.

The commonest and noisiest bird in Trinidad; too well known to need description. It is insectivorous: Of a sociable and quarrelsome nature.

The local name is derived from its call. The bird is not found in Tobago.

2. *Megarhynchus pitangua*. Linn. (*M. chrysogaster*. Sc.)
Broad-billed Qu'est-ce-qu'il-dit:—Length 9·75 inches.

Resembles the common Qu'est-ce-qu'il-dit superficially, but may be distinguished by its broader bill. It is rarer and more solitary than the preceding species. The bird utters a single harsh note: to listen for which is the easiest way of detecting it; its habit of sitting motionless on high branches making it not easily noticed. Insectivorous: not found in Tobago.

3. *Tyrannus rostratus*. Sc.

White bellied Qu'est-ce-qu'il-dit:—Length 9·5 inches.

Rather rare and possibly a migrant. The writer only noticed it in March and April, when several were seen separately.

It resembles the common Qu'est-ce-qu'il-dit in general appearance, except that the back is darker and the under parts are white instead of yellow. The dark brown feathers on the head conceal others of a brilliant yellow. It is insectivorous.

4. *Tyrannus melancholicus satrapa*. Licht. (*T. verticalis*. Leot.)

Grey headed Qu'est-ce-qu'il-dit:—Length 8·5 inches.

Upper parts grey; under parts yellow; head grey with the orange under feathers found in so many of this group. Common in Trinidad and Tobago. Its favourite method of catching insects is to select an elevated

position with a clear outlook, and await the approach of a desirable insect, when it will spring into the air, seize the insect on the wing and return to its perch.

5. *Milvulus tyrannus*. Linn.

Scissor tail. Length 13.5 inches.

Upper parts dark grey; under parts white; head black with bright orange feathers concealed beneath the black. It is easily distinguished by two outside feathers in the tail which often attain a length of 8 inches in the male, nearly double the length of the bird from bill to base of tail. These feathers open and close during flight like the blades of a pair of scissors. The female has a much shorter tail, duller colouring and a grey head. It is a migratory species, arriving from the Main in June and leaving again in October; frequents the open savannahs, feeds on insects and is found in Tobago.

ICTERINAE OR HANG-NESTS.

Three species are found in the Colony of this exclusively American group resembling the starlings of the Old World. These birds, however, use their feet to hold down their food, which starlings do not.

1. *Ostinops decumanus*. Pall. (*Casicus cristatus*. Gmel.)

Yellow tail. Length 18.5 inches.

Body black, rump dark reddish brown; tail feathers yellow with the exception of two intermediate ones which are black; bill primrose yellow; legs black; iris blue:

The female resembles the male but is slightly smaller. The young are black with a reddish tint. The birds have a strong musty odour, are of a gregarious nature and nest in colonies. The nests, woven pear-shaped structures about 30 inches in length, are generally suspended from the tips of palm leaves, and it is no uncommon sight to see a palm tree completely hung around with them. This habit of building on the extreme ends of the leaves must serve as a protection from snakes. The nest is said to be composed of the fibres of an aquatic plant, the bird cleaning off the pulp by running the stalks through its beak. It would be interesting to determine what plant is thus employed. This species has an extraordinary range of notes. It is practically omnivorous, devouring insects, fruit or seeds with equal avidity; is found in Tobago.

2. *Icterus Xanthornus*. Linn.

Corn bird. Length 9 inches.

Yellow except for a line of black which, starting at the base of the bill, ends in a broad splash on the throat and chest; wings black. The yellow of the back is slightly tinged with green. Tail black; tail-coverts yellow.

The young have a greenish yellow tinge and the black on the chest is absent except for a few feathers; legs, bill and iris black.

A very common bird preferring inhabited districts. The nest is suspended and made of strongly woven fibre like that of the preceding species. The eggs are heavily blotched with purple-brown.

It is mainly a fruit eater but does not disdain an occasional insect. It occurs in Tobago.

8. *Casicus persicus*. Linn.

Oorn Bird. Length 11·25 inches.

Head and body black; tail coverts, rump and base of tail yellow; extremity of tail black; wings black; wing covers yellow; bill pale yellow; legs black; iris blue.

The female resembles the male. A common bird, with the habits of the preceding species. Does well in captivity and is an excellent mimic. Fruit and insects form its food.

AGELAINAE.

This sub-family of the preceding group is represented by three species.

1. *Molothrus atro-nitens*. Cab.

Starling: Oat bird. Length 7·75 inches.

The male is a glossy blue black, legs and bill black, wings a dull black. Female a grey brown. The shading of the feathers giving a slightly speckled appearance.

It is a fairly common bird in Trinidad, especially in the vicinity of stables and other yards. In Tobago it is even more common, since it does not have to suffer persecution by the Qu'est-ce-qu'il-dit. The bird is parasitic, in that it does not build its own nest, but deposits its eggs in the nest of a species of wren (*Troglodytes rufulus* Cab.) The wren hatches the eggs with her own, but the young Oat bird soon outstrips the young Wrens in growth and finally ejects them from the nest. Its food consists of grain and insects.

2. *Liesles guianensis* Linn. (*L. americanus*. Leot.)

Robin. Length 7·25 inches.

Black except for a patch of bright red extending from the throat to the abdomen: wing feathers less dark: legs and bill brown. The female is a lighter colour and the red patch is less pronounced. The immature bird has no red colouring. Frequents open spaces and low bushes and searches for its food on the ground; probably feeding on small worms. The nest is placed in a bush near the ground. The local name "Robin" is probably derived from the fact that it has a red breast, like the English Robin to which bird however it is not related.

3. *Ogelaius icterocephalus*. Linn. (*Chrysomus icterocephalus*.) Leot.

Yellow head. Length 7·75 inches.

In the male the head and front of neck are yellow the rest of the body black: the legs and bill also black.

In the female the top of the head and neck are a greenish brown with a yellow spot between eye and nostril; throat yellow but less bright than in the male: under parts greenish yellow on a black ground upper parts black tinged with green. Immature birds resemble the female.

The bird is common in marshy places, especially rice fields, large flocks being found near San Juan. Food consists of insects and seeds. It does well in captivity, if kept in a roomy aviary, and thrives on unhusked rice.

TANAGRINAE OR TANAGERS.

An American sub-family chiefly confined to the southern part of the New World. They are chiefly fruit-eaters are of brilliant colouration, and build open nests. Trinidad has about 18 species of Tanager of which the following are the most common.

1. *Tanagra cana sclateri*. Berl.

Blue bird. Length 7.25 inches.

Upper parts pale blue becoming much deeper towards the rump; lower parts blue grey as are the head and neck. Flight feathers black, the wing-coverts a brilliant blue; tail blue; legs and bill black. The female resembles the male: the young are less vivid.

One of the commonest Tanagers. It is of a lively restless disposition and rather gregarious, preferring the neighbourhood of dwellings. The nest is cup-shaped the eggs pale blue with deep brown markings. Its food consists of fruit and berries. The Blue birds of Tobago seem to be rather brighter in colour than those of Trinidad.

2. *Tanagra palmarum melanoptera*. Hartl.

Palmiste. Length 7.25 inches.

Head and upper parts dull olive green, having a yellowish tint: under parts brown with a green sheen.

The bird is common and has similar habits to the preceding species. It feeds on fruits and berries.

3. *Calliste demaresti*. Gray.

Worthless:—Length 5.75 inches.

Upper parts green, lower parts also green but less vivid. The head and throat chestnut red. Legs slate grey; bill brown.

The colours of the female are not so bright as those of the male. The immature birds have no red on the head.

Fairly common in wooded places, preferring high trees. Its food consists mainly of fruit and berries.

4. *Euphonia violacea*. Linn.

Louis d'or simple corrupted into "Semp":—Length 8 inches.

Upper parts black, with blue sheen: Under parts bright yellow; wings black; legs and bill black. In the female the upper parts are olive green, the lower parts yellow-green.

This pretty little bird is common, and one of the best songsters the island possesses. For this reason it is often to be met with in captivity; generally in a cage so small as barely to allow the bird room to stretch its wings. It is a seed and fruit eater. The nest is open and cup shaped; the eggs two in number.

PIPRINAE OR MANAKINS.

A group of small South American birds, generally brightly coloured. They have small beaks and the two outer front toes are joined for half their length.

Trinidad possesses two species, Tobago one. (*Pipra parcola*; Blue blacked Manakin) not found in Trinidad.

1. *Manacus manacus*. Linn. (*Pipra gutturalis*. Leot.)

White throated Manakin:—Length 5.25 inches.

The head and back black: rump and flanks dark grey. The throat is white, the feathers standing out so as to resemble a beard. Flight feathers black; wing-coverts black and white; tail black; tail-coverts grey; legs yellow; bill black.

In the female the upper parts are green, under parts grey tinged with green; legs green.

Its food is mainly fruit and berries. The bird frequents woods and is of a lively and restless disposition. These birds have a curious habit of clearing little circular patches of ground of all leaves, twigs, etc., and then performing a sort of dance on the cleared space. When in flight a whirring noise is produced by the wing feathers rubbing together. The nest is suspended from the branches of a low bush.

2. *Pipra auro-capilla*. Licht. (*P. erythrocephala*. Leot.)

Yellow-headed Manakin;—Length 4 inches.

The head is bright golden yellow; the remainder of the body a glossy black; wings dull black; legs white, with a few red feathers over the thigh; bill yellow.

The female is olive green above and a lighter shade on the under parts. Flight feathers brown; upper wing-coverts green, lower wing-coverts white. The young resemble the female.

Frequents the depths of woods and is therefore not often observed. It feeds chiefly on berries.

TROGLODYTES OR WIRENS.

A small family mainly of South American birds, building domed nests and possessing great powers of song. In Trinidad there are two species of which the one described below is the more common.

Troglodytes rufulus, Cab.

House wren: God bird. Length 5.35 inches.

Upper parts brown, under parts greyish white; flanks red brown. The tail is carried erect.

This wren frequents inhabited districts almost exclusively, often building its nest on the eaves of houses and occasionally, if permitted, in the house itself. It has a surprisingly loud song for its size. This species would be even more common were it not for the Oat bird already described whose habit of laying its eggs in the nests of the wren must help materially to keep their numbers in check.

CROTOPHAGINÆ OR TICK BIRDS.

A remarkable family of birds related to the Cuckoos. Trinidad has two species.

1. *Crotophaga Ani*. Linn.

Tick Bird: Old Witch. Length 15 inches.

Plumage black, light violaceous on upper parts, the bill is parrot-like, curved and arched; in colour black, feet black, iris brown.

The female has the same colouration as the male.

The nesting habits of this bird are peculiar, several females co-operate in building one large nest in which they all lay their eggs and sit simultaneously. The nest is loosely put together and composed of twigs. It is generally placed in a bush a few feet from the ground. The clamorous cries of the large number of young birds contained in it make it difficult to overlook. The eggs are green with a thick chalky incrustation.

The Tick-bird is always to be found in the vicinity of cattle, feeding on the insects disturbed by the animals as they graze. As the cattle move along the birds go with them, occasionally perching on the backs of any that seem sluggish and inducing them to move by frequent peckings.

It is common everywhere in Trinidad. It was first observed in Tobago in 1826, but has now become very numerous. It is uncertain whether the original pair were introduced or migrated from Trinidad.

2. *Crotophaga major*. Linn.

Large or Marsh Tick-Bird. Length 21 inches.

Resembles *C. Ani* very closely except in point of size, *C. major* being considerably the larger. Its habits are not quite the same, as this bird does not venture out into the open or accompany cattle. It prefers wooded places, is of a more retiring disposition, and by no means common. Whether the females co-operate in nesting as do the former species is not known.

PICIDAE OR WOODPECKERS.

A large family of birds with strong wedge-shaped bills and zygodactylous feet, two toes pointing forward and two backward. The bill is specially developed for cutting and picking at the bark of trees in which the birds find their insect food. The tongue is very long, capable of great protrusion, and supplied with a sticky substance which causes insects to adhere to it. The birds run up trees (never down) clinging to the bark with their feet and supported by the stiff-pointed tail feathers. They are entirely insectivorous. There are fine species in Trinidad. Carpenter bird is a local name for members of this group.

1. *Campephilus melanoleucus*. Gmel.

Red headed Woodpecker. Length 15 inches.

Head red: throat black, a white band starts from each side of neck and unites in the centre of the back remaining upper parts deep black: under parts black transverse bars on a yellow ground: bill white, legs brown, iris orange.

In the female the head is black, with a red patch on each eye uniting at the back of the neck: otherwise as male. Fairly common.

2. *Ceophloeus lineatus*, Linn. (*Dryocopus lineatus*. Leot.)

Black throated Woodpecker. Length 13·75 inches.

Head red, throat pale yellow striped with black malar stripe from mandible red, upper parts black lower parts pale yellow faintly marked with black transverse bars; bill yellow, legs black, iris deep yellow. The female has no red on the head and no malar stripe: Rather rare.

3. *Celeus elegans*. Muell. (*C. cinnamomeus*. Leot.)

Yellow headed Woodpecker. Length 11·25 inches.

Head yellow tinged with red: rump and flanks dingy yellow: remainder of body reddish: a broad red malar stripe: bill yellow, legs greenish brown, iris pale yellow. The female resembles the male but has no malar stripe. Rather rare.

4. *Chloronerypes rubiginosus*. Swains.

Blue headed Woodpecker. Length 7·5 inches, wing from joint 4·25 inches.

Forehead and crown blue, occiput and neck red. Throat white striped with black: upper parts dull brown, under parts white, with transverse

black bars; malar stripe red, legs brown, bill and iris black. The female has no malar stripe.

5. *Dendrobates Kirkii*. Malh. (*Chloronerpes Kirkii*. Leot.)

Lesser Red headed Woodpecker. Length 7.5 inches, wing 3.5 inches.

On the head irregular red markings on a black ground rump red, upper parts dull brown, under parts white with transverse black bars. Throat white slightly speckled with black; bill, legs and iris black.

The female has a pale yellow ring round the occiput but no red on the head.

The easiest method of distinguishing these five species is by measurements. They all differ in length except *Chloronerpes rubiginosus* and *Dendrobates Kirkii*: these two however have different wing measurements which are therefore given above in addition to the length of body from tip of bill to end of tail.

STRIGIFORMES OR OWLS.

Nocturnal birds of prey of useful economic habits owing to the large quantities of vermin they destroy. They have large eyes directed forwards, the upper eyelid closing over the eye, and not the lower as in most birds. The outer and fourth toe being reversible they can perch with either one or two toes behind. Trinidad has five owls. The better known are:—

1. *Megascops brasiliensis*. Gmel. (*Ephialites portoricensis*. Leot.)

Eared Owl. Length 9.25 inches.

Upper parts brown with a reddish tinge, the centre of each feather is marked with black; under part reddish fading to a dingy white speckled with black on the abdomen and flanks; a white bar over each eye. On each side of the head are longer feathers which can be erected at will giving the bird a horned appearance. Although not by any means rare, this bird, owing to its nocturnal habits, is seldom seen. It has a rolling whistle. Its food consists of birds and small mammals.

2. *Glaucidium Phalaenoides*. Daud. (*Athene Phalaenoides*. Leot.)

Jumby Bird. Length 7 inches.

Upper parts brown, the feathers on the head having a reddish brown line down the centre of each. Throat russet brown; under part dingy white and brown in longitudinal stripes blended together.

The young have a brighter tint than the adults. This is a well-known bird, its flute like note can be heard at all hours of the day and night. Its food consists chiefly of small birds. Having made a capture it utters a few whistles on a higher note than usual, with which can be heard to mingle the cries of its victim. It is regarded as a bird of ill omen by the country people.

STEATORNITHIDAE OR OIL BIRDS.

There is only one representative of this family.

Steatornis caripensis. Humb.

Guacharo Diablotin. Length 19.75 inches.

Plumage chestnut brown with darker markings. The wings are brown with white spots; the abdomen is also spotted with white. The bill is hooked, and the gape wide, the corner of the mouth coming below the eye; there are numerous bristles at the base of the beak. Feet very short, the wings long and powerful. The food consists of fruit and berries. It is the only fruit-eating night bird. It feeds on the wing picking off the fruit as it passes the tree. The stones of the fruit are subsequently ejected from

the mouth. A species of palm *Thrinax argentea* growing in the Botanic gardens was visited nightly by these birds to the number of three or four as long as the tree remained in fruit. As the only known colonies of these birds are on the north coast of the Island, it is probable that they made the long journey nightly in order to secure food.

The Guacharo nests in caves, the nests, made of mud are placed on ledges; two to four white eggs are laid.

It is of economic value the young becoming very fat when about a fortnight old. They are then collected and the fat melted down into a colourless oil, which is used for purposes of cooking and illumination.

The bird is found only in Trinidad and on the north coast of South America.

GALBULIDÆ OR JACAMARS.

A Central and South American family of about twenty species, of which one only is found in Trinidad and Tobago.

Galbula ruficauda. Cuv.

Jacamar:—Length 10·75 inches.

Upper parts metallic green and bronze: under parts brown; throat white; bill black, pointed and slender, 2·25 inches in length; feet zygodactylous. The female is like the male except that the throat is light brown instead of white.

A strikingly beautiful bird and fairly common. It frequents shady situations and can often be seen along roads on which it is fond of squatting. The food consists of insects caught on the wing; the bird selecting a point of vantage on which to await the approach of its quarry.

The nest is made in holes in banks, generally an old lizard hole enlarged by the bird and about 18 inches in depth. Three or four white eggs are laid.

MOMOTIDÆ OR MOTMOTS.

A family of South American birds containing twenty-four species of which one inhabits Trinidad and Tobago.

Momotus Swainsoni. Gray.

King of the woods: Bootootoo —Length 16·25 inches.

Upper parts green; slightly metallic; under parts red brown, the breast having three small black feathers edged with blue-green. Head black with a green ring deepening to blue on the neck. Tail long; green. The two median feathers are prolonged beyond the others and are racquet shaped at the extremities. This effect is given by the bird itself nibbling off the barbs from the shafts to about an inch from the end of the tail. This fact have been proved by observations made on living specimens at the London Zoological Gardens. The bill is black with serrated edges; legs brown.

The nest is made in holes in banks tunnelled sometimes to a depth of five feet: Three or four creamy white eggs are laid. The bird is chiefly insectivorous, though it sometimes eats small berries and is fond of the seed of *Castilleja*. It has been unjustly accused of damaging cacao; many have been shot on this account but if their stomachs had subsequently been examined no cacao would have been found in them.

TROCHILIDÆ OR HUMMING-BIRDS.

An exclusively New World group of about five hundred species. Trinidad possesses or possessed fifty years ago sixteen varieties but it is to

be feared that two or three have since become extinct. The tongue of these birds is slender and very long: it is hollow and divided at the tip into two parts. The wing muscles are greatly developed and enables the bird to hover in front of a flower as does a hawk-moth.

Humming birds build very dainty open nests of various shapes which are either placed on or suspended from a twig. The nests are composed of wool hair and down often bound together with spiders webs and ornamented on the outer side with lichens. Two tiny eggs are laid. As might be expected many pretty legends have grown up around the Humming bird. In Trinidad the writer has been seriously told that it was wrong to harm them because they carried honey up to Heaven. In an early seventeenth century book of travels (*Purchas his Pilgrims*) the following quaint account of the Humming birds is given.

"They are very swift in their flight and in their flight they make a noise like the bee and they rather seeme Bees in their swiftnesse than birds, for they alwaies feed flying without sitting on a tree, even as the Bees doe flie sucking the hunnie from the flowers. They have two beginnings of their generation, some are hatched of eggs like other birds, others of little bubbles.....and it is a thing to be noted, a little bubble to beginne to convert itself into this most faire bird and unknowne to the Philosophers seeing one living creature without corruption is converted into another."

Some of the better known Humming birds are

1. *Amazilia erythronota*. Less.

Emerald Humming-bird.—Length 3·5 inches.

Upper parts metallic green shot with bronze, more vivid towards the base of the tail. The head is bright emerald green. Tail is black, short, with blue lower tail-coverts edged with white. The bill is black, except at the base of the lower mandible where it is reddish.

Fairly common.

2. *Agrytria chionopectus*. Gould. (*Polytmus chionopectus*. Leot.)

White-throated Humming-bird.—Length 4 inches.

Upper parts green with light bronze reflections; under parts white, occasional green spots. Wings steel blue. Legs and bill black.

Very common.

3. (*Chrysolampis Mosquitus*. Linn. (*Mellisuga Moschita*. Leot.)

Ruby crowned Humming-bird.—Length 4 inches.

Head ruby red, shot, with gold; throat topaz; this colour is iridescent and only seen from certain points of view. Under parts black; wing steel blue; tail bright red brown black at the tip. Bill, feet black.

Quite the most beautiful of the humming-birds of Trinidad.

Not very common.

Glaucis hirsutus. Gmel.

Balisier Humming-bird, or Brown Breasted Hummer.—Length 5·5 inches.

Head reddish brown; upper parts dark green; under parts reddish; white down on legs; wings steel blue; tail reddish; black at the extremity; bill upper mandible black, lower mandible yellow.

Fairly common and frequents the Balisier (*Heliconia Bihai*) in the large, boat-shaped bracts of which plant it no doubt finds a plentiful supply of insects.

PUBLICATIONS RECEIVED.

Practical Agricultural Chemistry.—(By S. J. M. Auld and D. R. Edwards-Kerr, p. 284, John Murray, London—5s. 0d. 1913.)

This volume is largely a manual of agricultural chemical analysis, arranged in six sections; Plant life. Soils. Fertilizers, Manures, Feeding stuffs, Dairy products, and Examination of Waters and Soap.

A useful feature is the provision of short summaries of information before descriptions of typical analyses; *e.g.*, page 36, the brief account of the nature, occurrence and constitution of alkaloids preceding methods for extracting caffeine from tea, estimating nicotine in tobacco and testing qualitatively five common alkaloids. Similarly before dealing with processes for examining the physical properties of soil, page 72, there occurs "the colour of any soil under examination should be noted, since within certain limits it is an indication of fertility, black and red soils being the most fertile. The colour is largely dependent on the proportion of organic matter and iron compounds."

The book contains no reference to recent experiments on the partial sterilisation of soils and its effect on their bacterial flora. In fact the chemistry of biological agriculture is scantily dealt with. In the photomicrographs facing page 34 the magnification is so small that the typical characters of maize starch are quite lost. No indication is given of the characteristic striation of potato starch and the field of wheat starch is unrepresentative. Pages 11 and 13 give an account of the Kjeldahl estimation of nitrogen, yet omit the modified method of distillation (in a current of steam) used in the best laboratories for the last ten years.

On page 14 the authors describe the proteins as "many" different complex bodies differing only slightly in chemical composition; evidently they refer to the percentage of carbon, hydrogen, nitrogen and oxygen but the statement will probably cause many students to believe that chemical constitution is indicated, whereas researches of the last twenty years have shown these highly complex bodies to differ as completely in chemical constitution, and therefore chemical properties, as turpentine and india rubber both of which compounds are composed of the same elements (carbon and hydrogen) in the same proportions.

A useful addition to the work would have been discussions on the interpretation of various analytical data. Without such interpretations, which require wide experience and mature judgment, analytical figures are frequently of little use.

H. S. S.

British Breeds of Live Stock (Board of Agriculture and Fisheries, Whitehall Place, London, S.W. Second Edition, 1913. 1/ or bound in cloth 2/. P. 146. Numerous plates).

"This handbook was specially prepared for the Brussels and Buenos Aires International Exhibition of 1910, with the special object of encouraging the export of British live stock. It has now been extensively revised, and it is hoped that it will prove of interest to all who are interested in live stock whether for exportation or otherwise."

The volume deals with the various breeds of horses, cattle, sheep and pigs. Information is afforded on such points as history of the breed, distinctive characteristics, colour, noted sires, milking qualities, value of crossing, suitability for foreign countries, etc. The majority of the breeds are illustrated by excellent plates.

A list of Breed Societies with places of sale and average prices of animals of each breed concludes a very useful volume, which has the additional merit of being published at a merely nominal price.

Journal of Agricultural Research.—Government Printing Office, Washington, 15 cents. (7½d.) per part. The United States Department of Agriculture has issued the first part of a new monthly publication—*The Journal of Agricultural Research*—which will, to a certain extent supersede some of the separate *Bulletins* formerly published. The new *Journal* will record scientific investigations, bearing directly or indirectly upon economic conditions of Agriculture, contributed by the staff of the Department, and also by investigators in State Agricultural Colleges and Experiment Stations.

The contents of Vol. I, No. 1 are: "*Citrus Ichangensis*, a promising hardy, new species from S. W. China and Assam," which appears likely to be of value as a stock for oranges, lemons, etc., in comparatively cool countries, as it grows wild farther north and at higher altitudes than any other known species of citrus. "*Cysticercus ovis*, the cause of tapeworm cysts in mutton," and "*The Serpentine Leaf Miner*." All three articles are fully illustrated.

W. G. F.

The Agricultural Journal of Egypt.—The *Journal* of the recently founded Department of Agriculture for Egypt has now entered on its third volume. The contents are largely devoted to cotton, the staple crop of the country and the current number Vol. III, Part I describes the method of distribution of cotton seed by the Department.

Citrus trees in Egypt are affected by various scale insects and the Department has undertaken their fumigation, the work being under the charge of Dr. L. H. Gough, the entomologist, who is well known in this Colony on account of his researches on the froghopper. He gives an account of the campaign for the year 1912–13 accompanied by a summary of the cost. The loss due to the principal scale insect (*Aspidiotus aonidum* L.) is estimated at 50 to 60 per cent. of the former profits and with low charges for fumigation, it is stated that the remedy not only pays for itself in the first season, but leaves a handsome profit for the owners over and above last year's takings. Other articles deal with the Cairo Sewage Farm, fruit trees, garden crops, the opium poppy, and the agricultural laws of Egypt.

W. G. F.

NOTES.

THE leave of Professor Carmody, the Director of Agriculture, has been extended for six months from January 28, 1914.

Mr. J. C. Kershaw left for England on December 8, 1913, at the expiration of the year for which he was appointed for the froghopper investigation.

Subject to the approval of the Secretary of State, Mr. P. L. Guppy, who has been working as assistant to Mr. Kershaw, has been appointed to continue the investigations for one year from January 1, 1914, under the direction of the Special Froghopper Committee consisting of His Excellency the Governor (Chairman), Hon'ble W. G. Kay (representing the Estate Proprietors), and the Director of Agriculture.

The Department of Agriculture has received a request from an Englishman, now in the Philippines, who has had experience as a planter in other parts of the tropics also, to be placed in communication with anyone who would be willing to allow him to enter into partnership or to be manager with an interest in the property, on a cacao or coconut estate in which he would be willing to invest £2,000. Further particulars will be supplied on application.

The Colony has recently been visited by the following officers from West Africa who came to study agricultural conditions and methods here:—

Mr. P. A. Lamb, Director of Agriculture, Northern Nigeria; Mr. D. W. Scotland, Assistant Director of Agriculture, Sierra Leone; Mr. Gill, Assistant Superintendent of Agriculture, Southern Nigeria and Mr. F. Evans, Superintendent of Agriculture, Southern Nigeria, (formerly of the Trinidad and Tobago Department of Agriculture).

With the exception of Mr. Evans, who was here only for two days, about a fortnight was spent by each in the Colony and as far as time allowed the various phases of agricultural work thoroughly inspected.

The year 1913 has proved the driest during the period of fifty-two years that rainfall returns have been taken at the Botanic Gardens. The total fall for 1913 was only 39.53 inches, nearly ten inches less than that for 1912, and 25.08 inches below the average for the last fifty-two years. In several parts of the Colony on the other hand 1913 was a wetter year than 1912 as shown in the summary of the rainfall for the two years given on pages 37 and 38.

METEOROLOGY.

RAINFALL RETURN FOR JANUARY TO DECEMBER, 1913.

Stations.	1913.		1912.	
	Dec.	Jan. to Dec.	Dec.	January to December.
<i>North-west District.</i>				
	In.	In.	In.	In.
St. Clair--Royal Botanic Gardens ...	1.82	39.53	5.64	49.35
Port-of-Spain--Colonial Hospital ...	1.70	39.65	5.38	36.04
" " Royal Gaol ...	2.02	36.84	5.81	44.39
" " Constabulary Hdqrs. ...	1.33	32.97	6.01	44.68
St. Ann's--Reservoir ...	1.99	50.70	7.84	64.97
Maraval--" " ...	2.35	58.94	6.71	62.70
" " Constabulary Station ...	2.42	67.48	5.96	64.40
Diego Martin--Constabulary Station ...	4.0	64.02	6.71	66.92
" " Waterworks ...	4.05	62.57	7.59	62.36
" " River estate ...	4.00	65.77	7.35	62.03
Fort George Signal Station ...	1.57	46.64	5.23	51.87
North Post " " ...	3.92	53.86	4.54	53.87
Carenage Constabulary Station ...	1.45	50.17	5.03	56.50
Carrera Island Convict Depot ...	1.32	38.96	6.22	41.68
Chacachucare Lighthouse ...	0.88	34.99	3.32	38.54
<i>Santa Cruz--Maracas District.</i>				
Santa Cruz--Constabulary Station ...	3.53	67.98	8.43	64.84
St. Joseph--Government Farm ...	3.71	46.72	5.04	52.48
" " Constabulary Station ...	4.16	50.16	5.30	46.93
Tunapuna--St. Augustine estate ...	3.85	52.85	3.59	46.89
Maracas--Government School ...	5.10	64.13	9.20	56.68
" " Ortinola estate ...	4.62	56.01	7.56	56.76
Caura--Wardour estate ...	5.34	53.48	6.09	51.86
<i>West Central District.</i>				
Caroni--Frederick estate ...	9.22	124.83	10.88	86.22
Chaguamas--Constabulary Station ...	5.92	65.64	7.32	60.64
" " Woodford Lodge estate ...	5.21	64.95	6.67	60.39
Carapichaima--Waterloo estate ...	5.70	57.93	6.25	59.35
" " Friendship Hall estate ...	9.30	72.30	11.10	72.32
Conva--Exchange estate ...	5.11	49.14	4.78	48.88
" " Brechin Castle estate ...	4.76	57.52	4.50	55.86
" " Perseverance " " ...	6.76	55.03	4.97	52.08
" " Camden " " ...	5.34	52.75	6.25	54.72
" " Milton " " ...	6.43	56.72	1.33	51.36
" " Spring " " ...	6.86	60.44	5.64	59.07
" " Constabulary Station ...	5.41	53.48	6.29	56.74
" " Esperanza estate, Savonetta ...	5.50	52.00	3.95	48.75
<i>San Fernando & Princes Town District.</i>				
Claxton's Bay--Forres Park estate ...	5.68	48.54	4.10	47.78
Pointe-à-Pierre--Bonne Aventure est. ...	4.82	55.70	6.38	60.06
" " Concord estate ...	6.07	60.83	7.50	60.67
" " Plein Palais estate ...	5.44	52.77	5.36	50.58
Naparima--Picton estate ...	4.28	43.46	5.37	47.56
" " Usine St. Madeleine estate ...	4.18	65.03	9.39	57.71
" " La Fortune estate ...	3.05	49.22	5.33	49.87
" " Lewisville " " ...	5.09	65.82	7.64	63.34
" " Tarouba estate ...	2.43	45.29	4.41	39.46
" " Union Hall " " ...	3.55	51.29	6.32	51.35
" " Palmiste " " ...	3.50	56.02	4.75	58.15
" " Hermitage " " ...	3.75	51.81	5.60	49.23
Princes Town--Craignish " " ...	4.59	59.03	10.34	53.84
" " Cedar Hill estate ...	5.42	58.62	7.17	48.66
" " Williamsville estate ...	4.40	58.16	8.98	55.37
" " New Grant estate ...	5.04	65.04	10.14	57.83
" " Constabulary Station ...	3.46	46.31	9.69	52.85

RAINFALL RETURN FOR JAN. TO DEC., 1913.—CONTD.

Stations.	1913.		1912.	
	Dec.	Jan. to Dec.	Dec.	January to December.
<i>San Fernando and Princes Town District.—(Cont'd.)</i>	In.	In.	In.	In.
Princes Town—Hindustan estate ...	5.55	61.37	...	...
" La Retraite estate ...	8.34	86.76	12.20	67.59
" Malgretoute estate ...	4.13	55.62	7.29	46.63
Savana Grande—Friendship and Ben Lomond estates ...	5.21	56.32	7.31	52.73
Poole—El Rosario estate ...	5.94	81.33	15.81	91.16
<i>Montserrat District.</i>				
Montserrat Constabulary Station ...	6.28	63.46	5.87	64.31
Bresso—La Vega estate ...	7.52	75.65	10.03	77.08
<i>Arima District.</i>				
Arima—Warden's Office ...	1.00	55.91	4.85	47.26
" Torrecilla estate ...	5.26	81.87	8.16	78.12
" Verdant Vale estate ...	...	...	6.65	68.95
San Rafael—Constabulary Station ...	7.07	89.89	8.34	80.98
Guanapo—Talparo estate ...	5.20	83.88	10.98	89.90
Tamana—Sta. Marta estate ...	6.71	95.35	14.89	102.56
<i>South-west District.</i>				
Oropuche—Constabulary Station ...	5.09	59.02	5.43	64.85
" Pluck estate ...	3.36	46.49	6.95	52.10
Siparia—Constabulary Station ...	7.25	84.01	10.46	78.53
Guapo—Adventure estate ...	3.34	59.99	7.37	62.64
Cap-de-Ville—Constabulary Station ...	6.08	86.77	9.43	70.12
Erin—La Ressource estate ...	7.12	71.55	9.51	57.99
" Industry estate ...	6.53	...	...	...
Cedros—Constabulary Station ...	3.13	47.03	10.51	53.37
" Perseverance estate ...	3.44	...	...	...
Idacos—Constance estate ...	...	...	6.65	45.97
Irois—Irois estate ...	8.35	75.97	11.42	...
<i>South Coast.</i>				
Moruga—Constabulary Station ...	6.19	62.27	9.66	58.61
<i>North Coast.</i>				
Blanchisseuse—Constabulary Station ...	2.81	84.43	9.87	72.21
Grande Rivière—Mon Plaisir estate ...	7.20	121.74	10.91	90.46
Toco—Aragua House ...	3.50	83.05	6.77	67.42
" —Constabulary Station ...	4.53	74.72	8.47	65.94
Point Galera—Light House ...	2.30	43.33	5.39	39.65
<i>East Coast.</i>				
Matara—La Juanita estate ...	6.97	103.27	12.14	83.08
Manzanilla—Constabulary Station ...	5.99	87.06	16.74	89.56
Sangre Grande—Sta. Estella estate ...	5.72	102.10	12.43	90.39
" New Lands estate ...	8.32	93.94	20.08	94.76
" Evasdale estate ...	7.17	102.36	13.71	97.96
" Grosvenor estate ...	8.44	100.00	14.80	94.25
Mayaro—Constabulary Station ...	5.69	68.14	14.30	71.45
<i>Tobago.</i>				
Tobago—Hermitage estate ...	5.01	83.50	8.39	75.87
" Riversdale ...	2.24	53.05	5.57	56.07
" King's Bay ...	3.43	71.46	7.26	62.27
" Roxburgh ...	4.25	84.00	10.34	71.94
" Lure estate ...	3.21	81.27	9.93	71.76
" Botanic Station ...	1.58	54.95	4.15	52.24
" Government Farm ...	1.34	37.75	3.37	40.59
" Lowlands estate ...	1.72	45.92	3.51	49.28
" Friendship estate ...	1.95	47.06	4.09	51.66

BULLETIN

DEPARTMENT OF AGRICULTURE,
Trinidad and Tobago.

VOL. XIII.]

FEBRUARY, 1914.

[No. 78.

CACAO.

EXCESSIVE CLAYING OF CACAO.

THE report of the Special Committee of the Board of Agriculture appointed to consider what steps should be taken to prevent excessive claying of cacao, some instances of which had been brought to notice, has already been published (*Bulletin, Department of Agriculture*. XII. November, 1913, p. 162). In accordance with the decision of the Board the report was referred to the Agricultural Society, the Chamber of Commerce and the Cacao Planters' Association, and the following report of the Agricultural Society was brought before the Board of Agriculture in December:

1. We had referred to us and have carefully considered the report of a Committee of the Board of Agriculture recommending that a standard be fixed for cacao, that not more than 2 per cent. clay be allowed, and that prosecutions are not to take place without the consent of the Cacao Committee of the Board of Agriculture and the Director of Agriculture.

2. We have had the advantage of conferring with the representatives of a Committee of the Chamber of Commerce appointed on the same subject.

3. We recognise, with the Committee of the Chamber, the grave injury to the reputation of Trinidad cacao likely to result in foreign markets from excessive claying, but we realise with them the difficulty of imposing legal restrictions upon the practice, and upon the carrying out of any law to give effect impartially to any such restrictions.

4. We therefore recommend that before any drastic measures be adopted a joint notice should be issued by the Board of Agriculture, the Chamber of Commerce, the Cacao Planters' Association, and the Agricultural Society, to be circulated throughout the Colony by the Wardens and otherwise, stating that complaints have been received with regard to representations as to the evil effect of excessive claying, and that if this be not discontinued it will be necessary to bring the matter to the notice of the Government with a view to the introduction of legislation making excessive claying a punishable offence.

(Sgd.) HENRY WARNER,

December 12, 1913.

Chairman.

The Board then approved of a notice, drafted by the Acting Director of Agriculture, to give effect to this recommendation.

This notice which has since been signed by the representatives of all the four bodies concerned, has been published in the press, and 1,000 copies, as large posters, have been issued by the Department of Agriculture to all the Wardens, the Inspector-General of Constabulary, the General Manager of the Railways, the Postmaster-General, the Chamber of Commerce, the Agricultural Society and the Cacao Planters' Association in order that it may obtain full publicity.

The notice is as follows :—

Excessive Claying of Cacao.

Warning.

Attention has been directed by buyers outside the Colony to the fact that some cacao exported is excessively clayed, and unless this is stopped serious injury to the reputation of Trinidad Cacao is likely to result in foreign markets.

The matter has been carefully considered by the BOARD OF AGRICULTURE, the CHAMBER OF COMMERCE, the AGRICULTURAL SOCIETY, and the CACAO PLANTERS' ASSOCIATION, and these bodies unite in hereby giving warning that if such excessive claying be not discontinued, it will be necessary, in the general interest of the Colony, to bring the matter to the notice of the Government with a view to the introduction of legislation making excessive claying a punishable offence.

Signed on behalf of :

Board of Agriculture :

W. G. FREEMAN, Vice-President (Acting.)

A. DEVENISH, Secretary.

Agricultural Society :

H. E. MURRAY, Vice-President.

EDGAR TRIPP, Secretary.

Chamber of Commerce :

ADAM SMITH, Hon. Secretary.

Cacao Planters' Association :

EDGAR AGOSTINI, Chairman.

FRED. EM. SCOTT, Secretary.

SOME NOTES ON THE MANURIAL EXPERIMENTS ON CACAO, 1912 TO 1913.

BY W. C. JARDINE, F.R.H.S.,

Wardour Estate, Caura; Member of the Board of Agriculture.

THE report by Mr. Joseph de Verteuil, Superintendent of Field Experiments, on the Manurial Experiments on Cacao 1912-13, conducted under the control of the Board of Agriculture was presented to the Board in November and has been published in this *Bulletin*. XII, December 1913, pp. 205-16. The discussion on the report was postponed to the January meeting of the Board, at which Mr. Jardine was unable to attend; he has since forwarded the following notes.—(Ed.):—

This is one of the most important reports which could come into the hands of the cacao planters of this colony. The subject, however, is such an exhaustive one that in a cursory review it is difficult to know what to include, and what to leave out; there are some points however which stand out prominently enough to deserve special remark.

The results so far show the difficulty—almost the impossibility—of drawing definite conclusions from manurial experiments made upon such heterogeneous cultivation as that of cacao in Trinidad, at least until an exhaustive record covering not less than five years is procurable. I have come to the conclusion that a comprehensive digest of the inferences it would be safe to draw from the results of such experiments at the end of that time would be one of the most difficult tasks any man could set himself; nevertheless, we will certainly be faced with such a necessity, and I do not envy him to whom the task may fall. I do not say this from any desire to discourage the work being done, but speak rather from the position of the patient who eagerly looks to his doctor to discover a cure for his troubles, and to whom the whole position looks rather vague in its present unripe state.

As an example of what I mean, if we follow the history of one particular treatment or combination of manures right through the series, we are faced with the most contradictory and disappointing results, which may be shortly expressed as—good,—no good,—fair,—not worth while,—and so on. Plot No. 1 for example shows that the combination of basic slag and sulphate of potash has apparently produced the following effect per tree over the previous year. On Santa Marta estate an increase of about 6 pods; on Esperanza a decrease of 4 pods; on New Grant an increase of 34 pods; on Santa Teresa a decrease of 2 pods; on La Compensacion an increase of 6 pods; on Santa Isabella an increase of 6.5 pods; and on Soconusco a decrease of 2 pods.

Here we have the very gamut of inconsistency, which if viewed in the light given by the corresponding control plots, appears to become confusion worse confounded, and it is abundantly evident that it would be useless at this stage to draw any but the most preliminary conclusions.

If we lump all the plots together and reduce the figures to averages, we will find—taking the same example—that 931 trees, (being parts of seven different estates in seven different districts), produced a net

increase over the previous year of 1,544 pods = 1.66 pods per tree, and deducting the average increase per tree on 19 control plots = .82 pods we find this treatment giving us an average net increase of .84 pods per tree, or 782 pods at a cost of about \$32 00; a result which need cost the planter no further study could this result be considered as at all conclusive.

There can be no possible doubt that the individual bearing capacities of the trees making up a plot exert a disconcerting influence on the diagnosis of results taken separately; but this is unavoidable, being characteristic of Trinidad cultivation generally, and so far as the effect of the manurial treatment is concerned, will eventually be reduced to a minimum as time passes and records accrue.

We may however, get a few very interesting glimmerings or forecasts of what will probably be established among other things at the end of a sufficient period, not the least important of which is the danger of applying caustic lime to the soil in a climate where bacterial action continues almost undiminished throughout the year, and the land is exposed to heavy inundations during the rainy season. The free use of lime has become considerable in Trinidad of late years, caused no doubt by its rapid effect upon the yield; but it should be realised that its action is in reality nothing but a rapid consumption of your capital in the form of organic fertility,—more particularly on light unmanured soils,—which will as certainly be followed by years of reduced yield. A glance at the plots which were limed the previous year will emphasise this.

An intensely interesting review (published in 1912) of the world famous manurial experiments at Rothamsted (which have been running now for over sixty years) by the former Director A. D. Hall, M.A., F.R.S., provides such valuable information that, although the experiments here and at Rothamsted are not completely analogous, many of the general conclusions undoubtedly apply, some of the more apposite of which are well worth quoting.

1. It is established that in the case of wheat—"a ten year period is not sufficient to eliminate the fluctuations in yield due to seasons."

2. That the continuous growth of some crops,—notably wheat,—does not unfit the land for that crop provided a suitable fertiliser supply is maintained. "If there is any toxic effect,.....this effect is..... in the case of wheat.....so small as to be negligible."

3. The reverse is the case with barley, while with clover and some other crops the impossibility of maintaining them consecutively on the same soil is well known, and while the present state of our knowledge does not justify us in ascribing this fact to toxins produced by these crops, the probability of such being the case is markedly allowed for.

4. That on two plots abandoned for over twenty years, one gained nitrogen at the rate of 92 lb. per acre per annum, the other 41 lb. per acre per annum, the greater amount of the former being due to the soil having three per cent. carbonate of lime, enabling free growth of leguminous plants, and the better action of the *free* bacteria in the soil which fix atmospheric nitrogen,—the *Azotobacter*.

5. "The higher the level of production the greater the waste, and in consequence, the additions of fertiliser must be doubly increased to maintain the balance." This is partly due to the high pressure (so to speak) at which the fertility mill is working, (reminding one of the disproportionate waste of coal required to produce a comparatively small increase of energy over a certain limit); and to the fact that certain groups of bacteria denitrify the organic matter, liberating free nitrogen.

6. That the ploughing or tilling of the soil brings about a destruction of the organic nitrogen, while leaving it undisturbed under vegetation causes the increase of the same.

7. That rain—at Rothamsted,—adds to the soil 4 lb. of nitrogen per acre per annum.

8. That plants short of potash will be specially liable to attacks of fungoid diseases.

Most of these facts have been recognised by agricultural science for a considerable time now, but they are very forcibly corroborated by the long scientific evidence of the Rothamsted experiments, and their significance in the same direction here will surely not be lost.

I have not attempted to go exhaustively into every combination, and perhaps the example I have chosen is the least consistent, but it will serve to show the difficulties which beset this line of investigation in Trinidad, and to emphasise Mr. de Verteuil's remarks as to the necessity of having the previous history of the plots. I think it is worth considering whether the manurial scheme should not be improved upon, and a wider scope given in the periods of application, while the yields of the plots for as many years previous to the experiments as possible should appear. Analyses of the soils of the plots before, and at intervals of several years after treatment would throw more light on the results to come.

The work which the Board is doing under this head is destined to be of inestimable value to the cacao industry in the future, and is one which more than deserves all the time and trouble which can be expended upon it.

Cacao Beetles and Thrips.—At the January meeting of the Board of Agriculture Mr. F. W. Urich the Entomologist said in connection with cacao beetles I have not come across any particularly severe attacks, but on many estates beetles and larvæ are being caught in numbers. The present time appears opportune for spraying trees with arsenate of lead as a means of preventing beetles attacking them, especially the young ones, from three to five years of age. The beetles show great activity during the dry months and spraying should be undertaken now before the water supply diminishes and before the dry weather is too advanced. With regard to the southern districts of Erin and Moruga, the spraying experiments will be resumed at Moruga this month, and at Erin in February. I would recommend that posters be printed calling attention to the cacao beetles and the method of dealing with them and that they should be put in conspicuous places in the districts badly infected.

With regard to thrips they are on the increase and should be sprayed before the new growth of leaves comes on or before the cacao changes its leaves in the course of the next few months. The present cacao crop has not been effected by thrips, but we must guard against any damage to the June crop. At the present moment in the Sangre Grande and Cumuto districts there is a number of thrips on the green pods. Many are destroyed in reaping operations, but some have an opportunity of migrating to the young leaves of chupons and new growths at the ends of branches. Besides spraying, thrips can be controlled by cultural methods; at Sangre Grande some fields affected by thrips in 1911 and 1912 were forked and limed in the latter part of 1912, and up to now they do not show enough thrips to be alarmed at or capable of doing damage.

SUGAR.

THE FROGHOPPER PEST IN TRINIDAD.

The Result of Mr. Kershaw's Mission.

MR. J. C. KERSHAW left Trinidad on December 8, 1913 after having been engaged for one year in the investigation of the frog hopper pest; his appointment was a special one the expenses being defrayed equally by the Government and by the proprietors of Trinidad sugar estates. As already noted (p.36) arrangements have been made for the continuance of the investigations for another year (the cost being shared as before) by Mr. P. L. Guppy who served as assistant to Mr. Kershaw. Soon after Mr. Kershaw's arrival in England he met the special sub-committee of the Imperial Bureau of Entomology and the proprietors and the following account of the proceedings at the meeting is taken from the *West India Committee Circular* xxix, Jan. 27, 1914, pp. 30-32:

On Wednesday, January 14, a meeting was held at the Colonial Office to receive a report from Mr. J. C. Kershaw on his investigations into the frog hopper pest in Trinidad.

The special sub-committee of the managing committee of the Bureau of Entomology which had met the proprietors of the Trinidad sugar estates in October, 1912, when Mr. Kershaw was recommended for the work in question, was called together to meet the proprietors again on this occasion. The Committee was represented by Mr. E. E. Austen (British Museum, Natural History), Mr. G. A. K. Marshall (Director of the Bureau), Sir David Prain, C.I.E., C.M.G., F.R.S. (Director of the Royal Botanic Gardens, Kew), Dr. A. E. Shipley, F.R.S. (Master of Christ's College, Cambridge), and Mr. A. C. C. Parkinson (Secretary of the Committee); the proprietors were represented by Mr. Thomson Aikman (St. Madeleine Factory), Mr. T. Prentice (Trinidad Estates, Ltd.), Mr. R. Rutherford (West Indian Estates, Ltd.), Mr. D. Wallace (Tennant's Estates, Ltd.), Mr. F. H. Watson (Kleinwort Sons and Company), and Mr. Algernon E. Aspinall (Secretary to the West India Committee). Mr. G. E. A. Grindle, Principal Clerk, West India Department, Colonial Office, attended the meeting.

In the unavoidable absence of Sir Daniel Morris, K.C.M.G., who had presided at the meeting in October 1912, Dr. Shipley took the chair. Mr. Kershaw, after making a brief statement as to his work on the frog hopper investigations in Trinidad, laid before the meeting a summary of his final recommendations as follows⁽¹⁾:—

RECOMMENDATIONS.

1. I strongly recommend that a search be made for an efficient egg or adult parasite of the frog hopper, but I think it very unlikely that any will be procured in islands near Trinidad, or any adjacent part of the mainland.

2. Meanwhile every effort should be made to get the Syrphid fly on the early broods of frog hopper.

(1) Mr. Kershaw's report has been printed as *Special Circular* No. 9, Department of Agriculture and also in the *Bulletin, Department of Agriculture* xii pp. 197-203—(Ed.).

3. Abandoned lands adjacent to cane-fields to be either put under a cover crop or grazed; traces to be hoed and the rubbish taken to the pens, especially just before the wet season.

4. All trash should be removed to the pens, and not returned to the fields till well broken up and sodden; and especially the trash of the two or three rows of cane nearest traces or grass land just before the wet season.

5. After the appearance of early broods of frog hopper nymphs they should be destroyed by hand picking; the early adult broods should be destroyed by kerosene-lysol emulsion or squeezing the leaf-sheaths, which-ever proves the quicker and more effective.

6. The later large swarms of adults should be destroyed as far as possible by trap-lights.

He thought that the five last recommendations should be carried out in any case, because even if efficient parasites were obtained and established in Trinidad, they could not become really effective for two or three years. He recognised that all his recommendations could not be thoroughly carried out at once, both on the score of expense and perhaps through want of labour; besides, the conditions varied on different estates, and it would be easier to carry out some of his recommendations on one estate than it would be on another. Nevertheless, these measures he thought could be put in force at least in those fields and traces where the first signs of early frog hoppers appear. In the meantime he urged that a search should be made abroad for effective parasites.

THE VALUE OF THE SYRPHID FLY.

Mr. Kershaw expressed the opinion that the most valuable natural enemy of the frog hopper in Trinidad was the Syrphid fly, and his assistant, Mr. Guppy is now breeding these flies with a view to getting them ready for distribution on the early broods of frog hoppers. During its larval stage each Syrphid fly kills some thirty frog hopper nymphs, and if only they can be brought to attack the early broods instead of waiting for the most part for the latter broods, much good would probably result. There might of course, be parasites of the Syrphid fly itself, in fact, there probably were; but they were not yet known, and he could not speak with certainty as to this.

DAMAGE BY ADULTS.

He laid emphasis on the fact that insufficient notice is paid to the damage done by the frog hopper to *leaves* of the canes. The sugar is extracted from the leaves by the sucking of the adult frog hopper, and consequently that amount of sugar is lost, as otherwise it would naturally be transferred to the stem before the leaf withers. This had already been pointed out in *Bulletin of the Department of Agriculture*; but Mr. Kershaw was understood to say that many of the local planters practically disregarded altogether this aspect of the question, and Mr. Marshall corroborated the statement that there was a general impression among the local sugar growers that the adult frog hopper did not do harm. In the face of the definite statements made by experts on this point, Sir David Prain said that a mistaken opinion of this kind should be once and for all removed, and he could hardly believe that it would now be necessary to argue the matter with any sugar planter.

TREATMENT OF TRASH.

Mr. Kershaw explained that the frog hopper lays its eggs at the base of the sheath of leaves in the rotten trash. If the trash be buried, the eggs are buried with it, and in due course a brood is hatched out; and even when the trash is first removed to pens there is always a danger that portions of the trash containing eggs may be left behind or the eggs may have already dropped into fissures in the ground from the rotting trash, and, once in the ground, having regard to the fact that the eggs are particularly tough and very minute (less than a millimetre in length), ploughing or harrowing may quite well leave the greater number of them untouched and undamaged ready to hatch out at the appointed time. As for the larva it has from its size and shape little, if any, difficulty in making its way to the surface from below ground, whatever the condition of the soil.

PARASITES.

So far he had failed to find a parasite which would destroy the eggs: a Chalcid had been experimented with, but the results were not satisfactory. Therefore, pending the discovery of some outside parasite, as to which he could as yet offer no suggestion, the Syrphid fly seemed to be the obvious parasite which attack the nymphs in the early as well as the late broods. In reply to an objection by Mr. Prentice that the Syrphid fly only attacks the nymph *after* the nymph has damaged the cane rootlets, Mr. Kershaw again pointed out that a large portion of the damage to the canes is done by the adult frog hopper attacking the leaves, that by means of the Syrphid it might be possible to stay this damage to the leaves, and that other measures which he had advocated in Trinidad must be relied on for the present to deal with the ravages of the frog hoppers in their early stage. With regard to the discovery of a parasite from outside, he proposed to go carefully into the matter in consultation with Mr. Marshall; one wanted to find a frog hopper as nearly akin to the Trinidad frog hopper as possible, and then to introduce the parasite of that frog hopper into Trinidad. South America or Central America might be more likely places in which to find the parasite required. In any case, he thought that by the middle of 1914 it ought to be known whether such a parasite was essential, as Mr. Guppy's work with the Syrphid fly should then have produced results one way or the other.

FROGHOPPER INDIGENOUS TO TRINIDAD.

Mr. Kershaw proceeded to state that in his opinion the frog hopper was indigenous to Trinidad; that it could and did breed in any kind of grass as well as cane-trash and that the nymphs feed on practically any kind of root. Moreover, the frog hopper spreads easily and rapidly; both male and female fly considerable distances, so that all waste land surrounding plantations is dangerous as likely to harbour the insect which can in due course fly to the canes and do damage to the leaves. He denied that frog hoppers lay eggs underground, as was suggested by one of the proprietors, although as stated above the eggs often found their way into the soil through fissures when dropped from rotting trash.

QUESTION OF LEGISLATION.

The possibility of enacting legislation to make it compulsory on all sugar growers to carry out the recommendations which had been put

forward was discussed, but the proprietors appeared to think that it would not be practicable to enforce any such regulations in the case of the small planters whose plots surround or intersect the larger estates and that in the circumstance it would be useless to pass a law which could not be universally enforced. The Chairman was not altogether convinced that this objection could not be overcome, and the question of legislation would certainly seem to be one well worth careful consideration by the local government. As regards the recommendations which he had had occasion to make from time to time while in Trinidad, Mr. Kershaw expressed himself as being generally satisfied with the way in which the managers of the estates had followed out his suggestions, and he felt that when his advice had been taken the result had fully justified it. In support of this opinion, he quoted specific instances, but he admitted that no one could possibly say definitely that such and such action had led to such and such results, and that no other circumstances had influenced events.

CLIMATIC EFFECTS.

As regards the effects of the weather, he was inclined to think that although there was a common belief that in wet seasons the canes suffered less from froghoppers than in dry, there was no real evidence that climatic conditions affected the incidence of froghoppers at all. The fact that in British Guiana, where the cane roots were often submerged under water, froghoppers were almost negligible as a pest did not necessarily prove that the common belief that heavy rains kept down the froghoppers was correct. In any event, the effect of weather was indirect, and so far as he could judge, quite incalculable. He attributed the comparative scarcity of the froghopper during the present season not to any special weather conditions but rather to a variety of measures adopted specially for the purpose of checking the pest.

TRAPS FOR ADULT FROGHOPPERS.

Incidentally, reference was made to the use of the hurricane lamps at night placed above a tray of kerosene or molasses to attract and trap the adult froghopper (the hurricane lamps were said to have worked far more satisfactorily than strong search lights) and to the picturesque fact the froghoppers which fell outside the tray were devoured by frogs or toads waiting in readiness below. In connection with these light traps it was mentioned that only 1.5 per cent. of the whole number of insects caught were females. Reference was also made to the possibility of treating the soil with kerosene and preparations of different kinds, but Mr. Kershaw did not hope for much success in this direction. Inasmuch, however, as nitrolin, used as a manure, had a slightly deterrent effect on the froghopper, he would advocate its use more generally.

FUTURE WORK.

After a brief discussion on other points of less importance, the Chairman read to the meeting the following extract from a despatch received by the Secretary of State from the Governor of Trinidad on the subject of the work to be carried on after Mr. Kershaw's departure:—

"I had a conference on the 3rd instant [December] with Mr. Kershaw, the Acting Director of Agriculture and the Hon. W. G. Kay, when the

following measures for continuing Mr. Kershaw's investigations were decided on:—

- (a.) Steps to be taken to cultivate artificially the Syrphid fly for the purpose of attacking the first broods of froghoppers;
- (b.) Mr. P. L. Guppy to be employed for a further term of twelve months in charge of the froghopper campaign, with salary at the rate of £350 from January 1, 1914, and to be required to furnish monthly reports;
- (c.) Provision of £50 for incidentals to be continued; and
- (d.) Mr. Kershaw to make enquiries in England as to a possible foreign parasite for the froghoppers which might be introduced here.

"The above proposals were agreed to by the Finance Committee at a meeting held yesterday on the condition that one half of the expenditure is paid by the Estate proprietors; and I have the honour to ask for your approval of them on this condition."

The Chairman then moved a vote of thanks to Mr. Kershaw commenting on the able way in which he had dealt with the extremely difficult piece of work, which few men would be equal to undertaking successfully. The vote of thanks was seconded by Mr. Prentice, who expressed on behalf of himself and his friends the gratitude which the proprietors felt to Mr. Kershaw and their entire reliance on him; he regretted that circumstances prevented Mr. Kershaw himself from carrying on the investigations which he had conducted for the past twelve months, but he did not hesitate to say that they could proceed with confidence on the lines which had been laid down.

INTRODUCTION OF SUGAR CANES FROM MAURITIUS.

The Department of Agriculture is arranging for the introduction of some of the best varieties of the Mauritius sugar canes through the kind co-operation of Mr. F. A. Stockdale, Director of Agriculture in Mauritius, and formerly Assistant Director in British Guiana. In exchange various sugar canes and other economic plants are being sent from this colony.

A case has recently been received containing cuttings of the canes referred to below. Unfortunately they arrived in poor condition and although they have been planted in a special nursery at St. Augustine in order that they may be kept under constant observation and carefully tended, it is by no means certain that they will thrive. Should this prove to be the case it is hoped that other plants will be obtainable later.

The following are the varieties with the descriptive notes by Mr. Stockdale which accompanied them:

Tanna Rouge or Striped Tanna.—This cane was introduced into Mauritius in 1890 from Australia, where it was under trial, having been

obtained from the New Hebrides. At the commencement it did not do very well, but after a time it became acclimatized and now yields heavily in some districts. It gives but few canes to the hole as a rule.

White Tanna.—A sport from the above which occurred in Mauritius about 1891 or 1892. This is now the standard cane and gives excellent results in many localities. The ratoons spring slowly if the season is not favourable.

M.P. 55.—A very good seedling raised by Mr. Perromat. It is planted very largely here, especially in the lower central section of the Colony.

M.P. 87.—Another of Mr. Perromat's seedlings, it is very vigorous, but the juice is somewhat poor.

<i>M. 1474</i> .—	}	Four of the best seedlings raised by Mr. Boname at the Station Agronomique.
<i>M. 1237</i> .—		
<i>M. 998</i> .—		
<i>M. 90</i> .—		

LIMES.

ADULTERATION OF LIME JUICE.

THE Government has received from Mr. E. P. Mousir, Secretary of the Canadian and West Indian League a report ⁽¹⁾ of the Chief Analyst of the Inland Revenue Department, Canada, with reference to the adulteration of lime juice. The Canadian Government standard for lime juice when sold for consumption is as follows:—

"*Lime Juice, Lime Fruit Juice* is the fresh fruit juice obtained from lime fruit (*Citrus limetta*); has a specific gravity at 20° C. not less than 1.030 and not greater than 1.040, and contains not less than 10 per cent. of solids and not less than 7 per cent. of free citric acid. Its optical activity (rotatory power to polarised light) lies between the limits + 0.95 and -0.95 of the Soleil-Ventzke scale when observed in a column of 200 mm. length at 20° C."

Mr. A. McGill the Chief Analyst reports that out of 30 samples analysed only 5 came up to this standard "Among the others several approximate more or less closely to it but at least 30 per cent. of the collection gives unmistakable evidence of being reduced by addition of water; or made from a second pressing of the fruit (*Nachpresse*) which amounts to the same thing. While nothing harmful to health is introduced it is clearly unfair to the consumer and to the honest manufacturer that a diluted fruit juice should be tolerated on the market while offered as genuine. If properly labelled so as to declare the presence of water no harm would be done."

In an article commenting on the report in the *Magazine of the Canadian and West Indian League* it is noted that "in justice to the British West Indies it may well be added that whatever adulteration occurs does not take place there, but in the countries where the article is prepared. Almost all the lime juice shipped from the British West Indies is in a raw or concentrated state to save freight charges and also to avoid the duty when coming to Canada the product being admitted free when imported in this form."

In the interests of producers of lime juice to whom harm may be done by the sale of a diluted and adulterated article the Canadian and West Indian League "has already sent information of the legal standard set to all English and Canadian makers of lime juice known to be selling their products in Canada. If after the lapse of a reasonable time, further analyses show that goods are being sold which are still inferior to standard or are not labelled so as to clearly make known this fact it is the League's intention to take further action in the matter."

(1.) Laboratory of the Inland Revenue Department Ottawa, Canada, *Bulletin No. 262, "Lime Fruit Juice"* July, 1913

BOTANICAL.

IMPRESSIONS OF THE FLORA OF TRINIDAD.

BY PROFESSOR D. H. CAMPBELL.

Dr. D. H. Campbell, Professor of Botany in the Leland Stanford Junior University, California is well known in the botanical world for his researches on the mosses and ferns on which groups *The Structure and Development of Mosses and Ferns* by him has been the standard text book for many years. Dr. Campbell spends the periodical extra long vacations so liberally granted by the Universities of the United States, in travelling in tropical countries and visited Trinidad in 1912 *en route* to England and thence to the Straits, Java, Borneo, etc., a region he has previously travelled in. Some account of his journey has appeared in the *Popular Science Monthly* for January, 1913, from which the following extracts of local interest are taken. [Ed.]

To most botanists in America a visit to the tropics is supposed to be a difficult and expensive undertaking, involving much special preparation and also a good many risks. The fact is, a trip to the West Indies is a very simple matter, and even a few weeks are sufficient to give one an excellent idea of the main features of a most interesting and characteristic tropical flora, and is no more expensive than a journey of equal duration in Europe. If one extends the trip to include the Isthmus of Panama and Trinidad, one sees to great advantage the rich and beautiful flora characteristic of equatorial South America, one of the most individual floral regions of the world.

There are various ways of reaching the West Indies and Northern South America, especially since the great development of the fruit industry, which employs many vessels plying constantly between the different ports of the Atlantic and Gulf States, and various ports of the West Indies and Central America. In addition, the Royal Mail (English), and the Dutch Royal Mail have steamers plying between New York and Europe *via* the West Indies and South America.

It may be mentioned, also, that a trip to the tropics in summer is not at all the trying experience that many persons suppose. Of course it is hot, and in most parts of the West Indies rainy in summer; but the heat never equals that sometimes experienced along our own Atlantic coast, and, moreover, there are none of the sudden changes that are so trying. The same clothing that is suitable for hot weather in New York will be found quite appropriate for the tropics.

With the great improvements in sanitation of late years there is very little danger from the fevers which formerly gave this region such a bad name. With ordinary precautions, there need be little apprehension on this score.

Having a few weeks at his disposal, the writer decided to go to Europe *via* the West Indies, instead of by the shorter, but infinitely less interesting, route across the northern Atlantic. Although Trinidad is reckoned with the West Indies, its flora is very different from that of the Antilles, and is essentially South American in

type. Trinidad is separated from the mainland of Venezuela by only a few miles and the plants are largely the same as those in the adjoining regions of Venezuela and have much in common with those of the Guianas.

During a stay of two weeks the writer visited only the northern part of the island. This is, however, the most interesting portion of Trinidad, as not only are the highest mountains here, but there is also a fine development of lowland forest, and a savannah formation much like that seen in Surinam.

Port-of-Spain is perhaps the most attractive of the West Indian towns, and offers much of interest to the botanist—both in the town itself and in the environs. The Botanic Garden in Trinidad is the best in the West Indies, and in addition to the many fine examples of tropical plants cultivated in the garden there is adjoining it a considerable tract of practically untouched jungle, which is easily accessible and is full of interest to the visiting botanist. The garden is now under the direction of Mr. W. G. Freeman, to whom the writer is under obligations for much kind assistance during his stay in Trinidad.

Close to the old Botanic Garden is the more recently laid out agricultural experiment station, where are to be seen many varieties of the principal tropical fruits, especially oranges and mangoes. The latter are especially fine in Trinidad.

Among the most striking features of the Botanic Garden are the palms of which there are many magnificent specimens, both native and exotic. In the town itself palms are planted in great numbers, especially the stately cabbage palm, "palmiste" of the French creoles, probably the finest of all palms. It is a common sight to see clumps of epiphytic orchids attached to the trunks of trees in the gardens of Port-of-Spain. These are said to be very beautiful during the early winter, but in July only a very few were in blossom.

In Port-of-Spain there are magnificent trees in the parks and gardens and along the roads. These are often of enormous size, and their branches are frequently covered with epiphytes of various kinds, among which the most conspicuous are the Bromeliads, and the curious *Rhipsalis Cassytha* a member of the *Cactaceae*, but very different from most of the family. This plant grows in immense pendant masses, sometimes ten feet or more in length, and is exceedingly common in Trinidad. Of the numerous large trees, the silk-cotton (*Ceiba*), the West Indian cedar (*Cedrela odorata*), and the sand-box (*Hura crepitans*) were the commonest of the native species; but mahogany trees of large size, and gigantic specimens of *Pithecolobium saman*, are frequently seen. A very curious native tree *Couroupita guianensis*, is sometimes seen planted. This produces many short branches from the main trunk, upon which the large red flowers are borne in great numbers. These are followed by enormous globular fruits of such size as to fairly entitle the tree to its popular name, "cannon-ball" tree. Space will not permit of any further enumeration of the beautiful and curious plants with which the gardens are filled.

Much of the country about Port-of-Spain is still but little disturbed, and even where it has been cleared, the neglected land soon reverts to jungle. The wetter lowlands abound in palms, aroids, scitamineæ, etc., much the same types that occur in the Guiana forest. The drier hillsides,

however, show a good many forms different from those of the lower levels. A very common palm of the dry hillsides is *Acrocomia sclerocarpa*, a species common to the Antilles, also, and very common in Jamaica. A very showy shrub of this region is a rubiaceous plant, *Warscewiczia coccinea*. In this plant, as in the related *Mussaenda* of the eastern tropics, one of the calyx lobes is much larger and petal-like in colour and texture. In *Mussaenda* this is white, but in *Warscewiczia* it is a vivid carmine red, and the whole inflorescence strongly suggests the familiar poinsettia—indeed the plant is known locally as wild poinsettia.⁽¹⁾

Ferns are much commoner in Trinidad than in Guiana, although at the lower levels they are not especially notable. Two species of *Schizæaceæ* were common near Port-of-Spain—a *Lygodium* sp. and *Anemia phyllitidis*.

A visit to a small waterfall a few miles away yielded a considerable number of ferns, including some small *Hymenophyllaceæ* and a *Danaea*, and also several interesting liverworts. In the Botanic Garden were also found two interesting liverworts, a large *Riccia* and a *Notothylas*.

While driving to the waterfall a fine white arum (*Spathiphyllum cannaefolium*) was seen in great numbers along the river, and the trail to the falls lead through a fine forest with tall trees and a luxuriant undergrowth of large ferns, some of which were small tree ferns. There were also many Aroids, some of great size—*Montrichardia* sp., *Philodendron*, *Anthurium*, etc. Some very showy Bromeliads, with fine scarlet bracts, were common as epiphytes, and also a good many orchids; but some of the latter were not in flower. These, with the gorgeous *Warscewiczia* and masses of the fine *Heliconia Bihai*⁽²⁾ made a magnificent picture of tropical vegetation in its most luxuriant aspect.

Small tree ferns (species of *Alsophila* and *Hemitelia*) were fairly abundant, and several young specimens of a *Danaea* were found on a wet bank, where there was also found a luxuriant growth of several interesting liverworts. The latter included species of *Aneura*, *Metzgeria*, *Symphogyna* (?), *Fossombronina* and *Dumortiera*.

In company with Mr. Freeman, Assistant Director of Agriculture, a very interesting excursion was made to the Aripo Savannah, some 25 miles from Port-of-Spain. This savannah was in many respects like the one visited in Surinam, but the vegetation was more luxuriant. There were similar groves of *Mauritia*, but even a finer species (*M. scitigera*). A number of beautiful ground orchids were found in flower, and a small *Drosera*, different from that found in Surinam, was common. Tiny *Utricularias* with yellow and purple flowers were abundant, and as in the Surinam savannahs, there were clumps of low bushes, largely *Melastomaceæ* and *Malpighiaceæ*, in the shelter of which was found a very interesting fern, *Schizæa pennula*, as well as several other ferns. Two species of *Lycopodium*, *L. cernuum* and *L. carolinianum* were common.

The forest adjoining the savannah was very beautiful, with fine palms—*Euterpe*, *Bactris*, *Attaleas*, *Maximiliana*, and others. A commelynaceous plant⁽³⁾ with yellow flowers was very abundant, (the same species was

(1) Chaconier is the best known local name for this handsome plant.—[Ed.]

(2) Balisier. [Ed.]

(3.) *Rapatea paludosa* Aubl. [Ed.]

also seen in Surinam) and there were the usual abundant epiphytic orchids and Bromeliads, as well as a number of small *Hymenophyllaceæ*.

In these woods were many specimens of a *Clusia*, growing first as an epiphyte, and sending down aerial roots, which finally completely strangle the tree upon which the *Clusia* has fastened itself. These parasitic trees, with their glossy magnolia-like leaves are extremely handsome, and much resemble in general appearance the species of *Ficus* so common in the eastern tropics, which have the same habit of strangling the tree which gives them support.

Trinidad has no very lofty mountains, the highest peak, Tucuche, being very little over 3,000 feet. The most interesting excursion made was to this mountain. In company with Mr. Freeman, Mr. Ulrich the Government Entomologist, and Dr. Chandler, an English botanist visiting Trinidad, the writer made the ascent of the mountain which offers no difficulties, and many interesting plants not found in the lower country were seen.

The route at first lay through extensive cacao plantations, which occupy much of the lower forest lands in Trinidad. Along the margins of the streams the showy Aroid, *Spathiphyllum carnaefolium*, made a fine show, and another conspicuous and interesting plant was the curious *Cyclanthus bipartitus*, a member of the small family *Cyclanthaceæ*, whose systematic position is something of a puzzle to the systematist.

Lygodium sp. and *Anemia phyllitidis*, characteristic ferns of the lower country, were abundant, and a number of other ferns were noted as well as a few liverworts. These, however, are much better developed at higher elevations where there are a number of species of tree ferns belonging to the genera *Alsophila*, *Cyathea* and *Hemitelia*. None of these attain large proportions, and neither in the number of species nor in the size of individuals can Trinidad compare with Jamaica.

At an elevation of about 1,500 feet the primitive forest begins—characterized by magnificent tall trees, whose species in most cases could not be determined. The dense undergrowth comprised large ferns, palms, heliconia, *Areceæ* of various kinds, and many shrubs and lianas, the whole forming a magnificent example of a wet tropical forest. That it was a "rain forest" we thoroughly appreciated, as we passed through it in a veritable tropical downpour which soon made every little ravine and gully the bed of a torrent, and much of the time we had to wade through these small cascades when they crossed the trail.

However, although thoroughly drenched, we finally reached the summit, where there is a shelter hut in which we were to pass the night. The rain ceased for the time being, and after a change into dry clothes the afternoon was spent exploring the upper part of the mountain.

Among the most noticeable plants of the summit were many *Bromeliaceæ*, mostly epiphytes, but some of them growing on the ground. The scarlet and yellow bracts of some of these were extremely showy. Several species of palms were abundant, and especially *Geonoma* sp. confined to the higher elevations. One of the most beautiful plants met with was a species of *Utricularia*, *U. montana*, sometimes seen in cultivation. Unlike most of the genus, this is an epiphyte, and the drooping racemes of big white flowers might very well be mistaken for an orchid.

As is usual at the higher elevations in the tropics, the lower plants are relatively more abundant than at lower elevations. Besides, the tree ferns there were many others, including several *Hymenophyllaceae* and two species of *Danaea*, which were growing abundantly upon the wet banks, and whose large liverwort-like prothallia were found in quantity. The wet banks also yielded a fair number of liverworts, and at the very summit the ubiquitous *Lycopodium cernuum* was abundant. Mosses and lichens also abounded, but no notes were made of the species.

To the botanist visiting this region for the first time, the abundance and variety of the palms will first attract attention. Many of them are exceptionally beautiful, and they often grow in large masses giving a characteristic stamp to the forest vegetation. Palms are a far more conspicuous feature in the South American tropical forest than in any part of the eastern tropics with which the writer is acquainted. The *Araceae*, also are more numerous and varied than in the tropics of the old world, and none of the old world forms can rival the giant scandent genera, like *Philodendron* and *Monstera*, which are so characteristic of the American tropical forests.

Of the numerous *Scitamineae* the common *Heliconias* with their gorgeous inflorescences will first attract attention, and of course the peculiarly American family, *Bromeliaceae*, will be of special interest to the European visitor.

The prevalence of showy flowers in Surinam was noteworthy, as this is not a common feature in the wet tropics, a fact frequently commented on by scientific travellers. Whether or not the two go together, it may be mentioned that in Surinam there is also an extraordinary abundance of brilliant butterflies, some of them of wonderful beauty.

In Trinidad the prevalence of the showy flowers was much less marked than in Surinam, although it is by no means deficient in striking flowers. As has already been stated, Trinidad in the main features of its flora, belongs rather with the continental region of South America than with the other islands of the West Indies.

RECENT ADDITIONS TO THE BOTANIC GARDENS.

Orchids, Caladiums and Cannas.

As recorded in the *Annual Report* for 1912-13 efforts are being made to increase the collection of orchids which in previous years had been greatly reduced. A new orchid house has been constructed near the fern houses in Government House Gardens and a considerable number of local species obtained by collection, purchase, and gifts by Mr. C. S. Rogers the Forestry Officer, and Mr. Swarder of Tobago.

During the present year other orchids have been received from Dr. Hans Goldschmidt and Messrs. Sauder and Sons in exchange. Many of these are handsome *Cattleya* hybrids and other showy tropical orchids which it is hoped will form attractive additions in due course. The list of these recent acquisitions is as follows:

(A.) FROM DR. HANS GOLDSCHMIDT.

Cattleya guttata Leopoldii x *Laelia cinnabarina*.

Laelio-Cattleya Lowi (*callistoglossa* x *cinnabarina*).

Cattleya Mrs. Pitt (*Harrisoniae* x *aurea*).

- Cattleya Mantini* (*Bourringiana* x *aurea*).
Laelio-Cattleya Lowi.
Brasso-Cattleya Loddigesi-Digbyana.
Cattleya Mastersoniæ (*Loggesi* x *labiata*).
 „ *Mendeli* x *Laelia purpurata*.
Laelio-Cattleya elegans (*purpurata* x *Leopoldi*).
 „ „ *Canhamia* (*Mossiae* x *purpurata*).
Cattleya hybrid.
 „ *Trianae*.
 „ *Mossiae*.
 „ „
 „ *Schroderae*.
Stanhopea saccata x *tigrina*.
 „ *tigrina* x *saccata*.
 „ „ x *Wardi*.
 „ *insignis flava* x *tigrina*.
 „ *Wolteriana* x *tigrina*.
Cattleya labiata autumnalis.
 „ „ „

(B.) FROM MESSRS. SANDER AND SONS.

- Laelio-Cattleya Kathleen*.
 „ „ *elegans*.
 „ „ *Statteriana*.
 „ „ *Gottoiana*.
 „ „ *Nysa*.
 „ „ *Decia*.
 „ „ *fascinata*.
Cattleya labiata.
 „ *Prince of Wales* x *labiata*.
 „ *Gaskelliana*.
 „ *Harrisoniac* x *Laelia flava*.
 „ *gigas Sanderiana*.
 „ *Percivaliana*.
 „ *intermedia* x *Cattleya Percivaliana*.
 „ *Trianae*.
 „ *Gaskelliana*.
 „ *labiata*.
 „ *Mossiac*.
 „ *Mendelii*.
 „ *Schroderae*.

(C.) FROM MESSRS. REASONER BROTHERS.

From Messrs. Reasoner Bros. of Florida a collection of forty-four different named varieties of *Caladiums* and twenty-three of *Cannas* have also been received in exchange. The former are already coming into growth and promise to yield some handsome plants. They are planted out in the border of the Orchid House.

In both *Caladiums* and *Cannas* the gardens were previously very deficient and material will it is hoped soon be available to make better displays of these thoroughly tropical groups of plants than has been practicable in the past. The other desideratum is a season of normal rainfall.

W. G. F.

NURSERY WORK.

Plants Sold and Distributed from St. Clair Experiment Station, October 1, to December 31, 1913.

PLANTS.

	Sold.	Distributed in exchange or gratis.
Coffee (Robusta)	4,562	50
„ (Other varieties)	2,204	...
Citrus (Budded)	25	...
„ (Seedling)	80	...
Cacao	1,555	...
Decorative flowering	175	48
Decorative foliage	158	7
Mango (Grafted)	31	3
Miscellaneous fruits	149	4
Miscellaneous	491	...
Orchids	23	102
Palms	385	18
Rubber... ..	8	...
Spices	57	...
Shade	56	4
Timber	26	...
Totals	9,985	236

SEEDS.

	Sold.	Distributed
Coffee Seeds (Robusta)	22 lb.	...
Countable Seeds ... ..	...	760
Packets Seeds	9	22
Pods ... ..	...	4

The Receipts during the same period amounted to £188 4 8.

AGRICULTURAL EDUCATION.

EAST INDIAN AGRICULTURAL INSTRUCTOR.

THE appointment as an East Indian to be an additional Agricultural Instructor has been under consideration since 1909. The question came before the Board of Agriculture early in 1910 but such an appointment was not then recommended because after enquiries a suitable candidate with the necessary practical knowledge was not forthcoming.

In February 1912 the question arose again when, as the outcome of representations made to the Governor by a deputation of the East Indian National Congress, His Excellency recommended the training of an East Indian for the work, and the Board endorsed the suggestion and recommended the training of a man by the Department of Agriculture at River Estate with a view to his subsequent appointment as an Agricultural Instructor. This experiment did not succeed the candidate proving unsuitable after about seven months' trial.

The idea then remained dormant again until December 1913 when it was once more revived by Mr. C. D. Lalla and as the outcome of proposals which he made the Board of Agriculture recommended another trial under somewhat different conditions. The former probationer had been paid entirely by River Estate for the value of his services. The Board now agreed to contribute in addition to such wages a subsistence allowance of £25 per annum to enable a man of better education being able to accept the post. The recommendation of the Cacao Prize Competition Committee which was adopted by the Board was as follows :

That the candidate be appointed for one year to be trained under the Department of Agriculture as an Agricultural Instructor. That the Board contribute £25 as a subsistence allowance provided satisfactory reports of progress are received from the Director of Agriculture. That at the expiration of the year's training, he be appointed an Agricultural Instructor on passing a theoretical and practical examination to the satisfaction of the Board.

That the appointment may be terminated by one month's notice on either side.

CACAO PRIZE COMPETITION.

This year's competition is now drawing to a close and the judging in the two districts (1) St. Ann's and Diego Martin and (2) Couva and Chaguanas is due to take place. The judging will be on the same lines as last year *i.e.* the two Inspectors and one cacao planter in each district. At the January meeting of the Board it was decided that for 1914-15 the districts should be (1) Siparia and Erin (2) Brasso to Piparo.

Siparia and Erin is a new district altogether for the competition whilst the second district will also be largely new. It is hoped in this way to extend the benefit of the competition to areas which have not as yet been worked.

A new feature of this year's competition will be the offering of prizes to the value of £10 in each of the two districts for vegetable cultivation. These will be in addition to the prizes for cacao cultivation. The details of the competition for 1914-15 will be issued shortly.

HOME READING COURSES.

The Home Reading Courses in Practical Agriculture conducted by the Department are now under the charge of Mr. J. C. Augustus. The number of students continues to increase, a marked feature this year being the entries for the Advanced Course; these students have already passed both the preliminary and intermediate stages.

The following is the list of students for 1914:

Preliminary.

Thomas A. Hoscini	...	...	Nipal C. M. School.
Austin Millet	...	...	Carapichaima.
J. F. Chittendou	...	...	Riversdale Estate, Tobago.
Joseph C. Martin	...	...	Realize Road, Princes Town.
William Walkins	...	...	Erin.
Hubert Rat	...	...	Erin.
Bertie McLean	...	...	Amundale Estate, Erin.
Dudley Joseph	...	...	Peper Village, Erin.
Gustav A. Krogh	...	...	El Regalo Estate, Tunapuna.
A. T. Warner	...	...	Government Farm.
T. R. Hezekiah	...	...	Sta. Marie Estate, Chatham.
Paul Anderson	...	...	St. Clair Experiment Station.
X. Baker	...	...	do
H. Borde	...	...	do.
J. E. Worsfold	...	...	do.
G. Nonigh	...	...	do.
W. Jagbilsingh	...	...	do.
Nabie Bocus	...	...	do.
Octave St. Rose	...	...	River Estate, Diego Martin.
Sylvestre Arneaud	...	...	do.
John Bishop	...	...	do.
Philip Alston	...	...	Redhead Village, Toco.
George Archer	...	...	Carapichaima.
J. Blenman	...	...	Cedros.
M. Murray	...	...	Diego Martin.
Joseph Seedansing	...	...	Jordan Hill C. M. School.
J. Brijlalsingh	...	...	Lengua C. M. School.

Intermediate.

Pedro Marcano	...	...	Manzanilla.
Thomas A. Hodge	...	...	Tortuga.
A. V. Waddell	...	...	St. Clair Experiment Station.
J. A. Pegus	...	...	do.
Edgar McKay	...	...	do.
A. Cuthbert	...	...	River Estate, Diego Martin.
V. Rhonde	...	...	Botanic Station, Tobago.
Atis Agostini	...	...	Denmark Estate, Chatham.
John Menzies	...	...	Erin.

Advanced.

A. Brunton	St. Clair Experiment Station.
Patrick E. Walke	...	...	do.
Claudius R. Hoyte	...	...	River Estate, Diego Martin.
Rawson H. Leacock	...	...	do.
E. Gibbs	...	...	Botanic Station, Tobago.
Antony Wood	...	...	do.
Cecil Webber	...	...	do.
Locaris Mota	...	...	Gran Couva.
J. A. Cumberbatch	...	...	St. Isidore Estate, Sangre Grande.
Anthony Negretti	...	...	65, Dundonald Street, City.
James Reid	...	...	Manzanilla.
A. J. Roxburgh	...	...	Industry Estate, Erin.
C. L. Rawlins	...	...	El Perial Estate, Erin.
Adolphe Raphael	...	...	Cumana Road School, Toco.
Cobham Ballack	...	...
Fitz Peter Andrews	...	...	Sta. Cruz.

REPORT ON COURSE OF FARRIERY INSTRUCTION AT SAN FERNANDO.

AT a meeting of the Technical Committee of the Board of Industrial Training, held on November 17, 1913, I was directed to prepare a report, to include a statement of account, on the course of Farriery Instruction recently completed in San Fernando. There was also a suggestion that a copy be forwarded to the Board of Agriculture. It will be within the recollection of members of this Board that the idea of doing something to improve horse-shoeing in the colony was first suggested by His Excellency the Governor as far back as November, 1909. To place themselves in a position to understand how such instruction should best be given, the Board communicated with the Worshipful Company of Farriers in England. This Company is not only the examining body of shoeing-smiths in the Mother Country, but it has a large experience of the courses of instruction there given, and under its advice the Board drew up a syllabus, obtained dissectable and model hoofs, lantern slides, model shoes and other equipment. In fact, the Board's property in this respect is very valuable and modern.

Farriery instruction has been given in Port-of-Spain, with varying success from the beginning of the year 1911. It was from the first the hope of the Board to extend the instruction to the country districts, but it was carrying out a comparatively large scheme of technical instruction in Port-of-Spain, which absorbed its relatively very small vote completely. In these circumstances, on March 17, 1911, the Board laid the position frankly before the Board of Agriculture, which at once most generously granted this Board the sum of £25 per annum, for two years, to carry the course of instruction into the country districts. It is perhaps a far cry from the early part of 1911 to September 18, 1913, when the course of instruction at San Fernando was opened, but the voluminous correspondence in the Board's Office on the subject shows that the delay has been

no fault of the Board of Industrial Training. Several times the shoeing-smiths of the districts were circularised, but the response was not sufficiently favourable to make a start; there were other difficulties, and one was that it was considered advisable to give the course of instruction only in the "off crop" season.

It must be highly gratifying to this Board and to the Board of Agriculture to know that the ten lectures given by Dr. Charles L. Boissière, V.S., F.V.M.S., on "The Art of Horse-shoeing," commencing on September 19, and ending on November 20 last, have been a pronounced success. In England, similar lectures on the principles and practice of horse-shoeing, and the care and management of the feet of the horse, which were recently given by some of the County Councils, not only attracted shoeing-smiths, carters and grooms, but they also attracted horse-owners who took a very real interest in the course of instruction. While this has not been the case in Port-of-Spain, it was, to some extent at least, at San Fernando, and many horse-owners and gentlemen of influence in the neighbourhood attended the lectures frequently. I am reliably informed that nearly forty shoeing-smiths of San Fernando and district regularly attended the course, some of them coming from Williamsville, Diamond Village, Pointe-à-Pierre, Oropuche, St. John and other outlying districts.

On two occasions, His Excellency the Governor attended and took the chair; the Chairman of the Board went down on one occasion, as did the Chairman of the Technical Committee, and the Hon. J. D. Hobson attended once at least, and would have presided at the opening lecture but for illness which necessitated him going to Barbados. The Rev. Father Cantwell generously gave the Board the use of his school room, and at its request took the chair at the opening lecture and on other occasions. The great personal interest Father Cantwell took in this matter contributed no doubt very largely to its success, as well as the interest displayed by the Hon. J. Moodie, who is a member of the Board of Agriculture, and who has also attended the lectures on several occasions. Mr. Moodie has suggested that the salient features of these lectures should be embodied in pamphlet form and issued to shoeing-smiths on the estates and elsewhere in the Colony; Dr. Boissière has very kindly promised to get up such a pamphlet, if the Board so desires. I attended the lectures on three occasions myself, and was very much struck with the keen interest with which they were followed by shoeing-smiths, many of whom asked questions of the lecturer, which were in all cases answered. At the last meeting, I was asked if the Board would allow some of Mr. Frank Watson's model shoes to remain in care of the Warden at San Fernando, where they could be more closely and leisurely inspected by the shoeing-smiths than was possible at the lectures; the latter said that from careful examination of some of these shoes they were convinced that they could learn a good deal. I replied that the Board's sole object in going to the expense of importing these shoes was that they should be of benefit to the shoeing-smiths of the Colony, and that I would venture to pledge the Board to send down a selection, with a typewritten description of each shoe if the Warden would kindly undertake to take care of them. While in San Fernando, I was asked by several people if the Board would give a course in Princes Town sometime next year, and this is a matte

which is now before the Technical Committee, the main consideration being one of expense.

The total cost of the course of instruction has amounted to \$128.18, expended as follows :—

Printing and Advertising	...	...	\$25 16
Fees and Expenses of Lecturer	...	...	47 12
Fees and Expenses of Lanternist	...	...	10 14
Railway Fares	...	...	31 07
Cost of Removal of Equipment and other			
Miscellaneous Expenses	...	...	9 64
Total	...	...	\$128 18

T. B. JACKSON,
Secretary Board of Industrial Training.

December 1, 1913.

AGRICULTURAL LEGISLATION.

FARMERS' ADVANCES ORDINANCE.

TRINIDAD AND TOBAGO.

Farmers' Advances.

No. 28.—1913.

12th November.

AN ORDINANCE relating to Advances to Farmers.

[L.S.]

GEORGE R. LE HUNTE,

GOVERNOR.

27th November, 1913.

BE it enacted by the Governor of Trinidad and Tobago with the advice and consent of the Legislative Council thereof as follows :—

Short Title.

1. This Ordinance may be cited as the Farmers' Advances Ordinance, 1913.

Interpreta-

-tion.

2. In this Ordinance the term—

“Farmer” means the person cultivating in sugar cane or rice any parcel of land whether as owner, lessee or tenant thereof or as being a person to whom such parcel has been given out, leased or allotted for the purpose of cultivating the same in sugar cane or rice or partly in sugar cane and partly in rice.

“Magistrate” means the Magistrate for the district in which the land in respect of which an advance note is given is situated.

“Clerk” means the Clerk of the Peace of such district or the chief clerk to such Magistrate.

“Advance” means a sum of money secured under the provisions hereof, the interest (if any) payable in respect of which shall not exceed ten per cent. per annum.

“Advance note” or “note” means a note given and filed in pursuance of this Ordinance.

Advance note.

3.—(1.) Every advance under the provisions of this Ordinance shall be evidenced by an advanced note in the form in the Schedule hereto and shall be signed in duplicate by the parties thereto in the presence of a Magistrate, Clerk, Warden, Justice, Inspector appointed under the Board of Agriculture Ordinance, 1908, or under the Plant Protection Ordinance, 1911, or of any other person duly appointed for such purpose by the Governor.

(2.) Every advance note shall contain the following particulars :—

(a.) The names of the person making the advance and of the farmer;

(b.) The amount of the advance and the rate of interest thereon;

- (c.) The extent and situation of the parcel of land, the crops and buildings on which are to be subject to the advance note;
- (d.) The factory, if any, and the price agreed upon at which the canes or rice are to be delivered;
- (e.) Whether there is in existence any charge affecting the subject matter of the note;
- (f.) The purpose to which the money advanced is to be applied.

(8.) Every advance note shall truly set forth the consideration for which it was given, otherwise such advance note shall be absolutely void.

(4.) Each separate advance shall be evidenced by an advance note.

4. One part of every advance note (hereinafter called a duplicate) shall immediately on its execution be deposited by the person making the advance with the Clerk, and the other part shall be retained by such person. Filing of duplicate.

5. Before attesting the execution of an advance note the Magistrate, Clerk, Warden, Justice, Inspector appointed under the Board of Agriculture Ordinance, 1908, or under the Plant Protection Ordinance, 1911, or other person duly appointed for such purpose by the Governor shall explain its terms and conditions to the parties thereto and shall satisfy himself that the same are understood. Note to be explained to parties.

6. An advance note duly executed under this Ordinance shall not be deemed to be a "Bill of Sale" within the meaning of the Bills of Sale Ordinance or a "Contract" within the meaning of the Agricultural Contracts Ordinance or a Contract or Metairie Contract within the meaning of the Tobago Metairie Ordinance. Note not to be Bill of Sale. (No. 65).

7. An advance note shall not be deemed to affect the title to land, and shall not be capable of registration in the office of the Registrar (General) or under the Real Property Ordinance, but every purchaser of land the canes, rice or buildings upon which is or are affected by an advance note duly filed under the provisions hereof shall be deemed to have notice of any such advance note. (No. 310). Note not to affect title.

8. The Clerk shall file in his office all duplicates delivered to him in order of their receipt, and any person shall be entitled to inspect the file on payment of a fee of sixpence to be received by the Clerk, and to an office copy of any note filed therein on payment of a fee of sixpence to be received by the Clerk. File of notes.

9. The Clerk shall at the request of any person and on receipt of a fee of one shilling prepare an abstract of all advance notes duly deposited against any farmer. Abstract of notes.

10. Every advance note shall during the currency thereof but not otherwise, create a charge in favour of the person making the advance on all canes and rice which shall be grown and become ready to be reaped on the land described in the note and also upon the buildings, if any, erected, or to be erected, on such land and mentioned in such note; and subject to any rent which may then be due or which may during the currency of such note accrue due, such charge shall be entitled to priority according to the date of the filing of such note and shall be a security for the amount due thereunder. Note to create charge on crop and building.

Penalty for
false state-
ment in notes.

11. Any farmer who signs a note containing a statement that there is no charge affecting any canes, rice or buildings, whereas in fact there is in existence such a charge, or containing a statement mentioning fewer charges than are in fact in existence, is liable on summary conviction before a Magistrate to a penalty not exceeding £25 or to imprisonment, with or without hard labour, for a period not exceeding three months.

Expiration of
note.

12. Every advance note shall remain in force as a valid security for two years from the date thereof, unless the same shall have been previously paid off; provided always that nothing in this section or in Section 10 hereof shall affect the liability of a farmer under the provisions of Section 17 to continue delivery of his canes or rice as therein mentioned, or the provisions of Sections 14, 15 and 16 of this Ordinance so long as such liability to continue delivery exists.

Money remain-
ing due on
note.

13. If any money remains due by the farmer on the advance note at the end of two years from the date thereof, it may be sued for as a debt or may be secured by a fresh advance note secured on the buildings, if any, which were subject to the previous note and also on the succeeding year's crop to be made in a similar manner; but the duplicate part deposited with the Clerk shall at the expiration of the note be returned to the farmer if the whole has been paid off and if no liability to continue delivery under Section 17 of this Ordinance exists, or to the person advancing the money if anything remains due thereon, and shall in no case be retained on the file after the expiration of two years from the date of the note.

Entry and
inspection.

14. The holder of any advance note shall be entitled to enter upon the lands, the crops or buildings on which are affected by such note and inspect such crops or buildings.

Transfer of
note.

15. Every advance note may be transferred by the holder by endorsement and delivery, and the transferee after notice of such transfer has been given to the farmer and the Clerk, shall be deemed entitled in all respects as if he had been the person in whose favour the note was given. Provided that the Clerk shall on receipt of such notice cause a memorandum of such transfer and the date of notice thereof to be entered on the duplicate filed in his office.

Transfer of
interest in land
by farmer.

16. Any farmer may, with the consent in writing of the holder of any advance note affecting his interest in any land, transfer such interest to any person, and such person shall be held bound by such note and shall be liable in all respects as if he had been the person by whom the advance note had been made. Every such transfer shall be made in writing and shall on presentation thereof to the Clerk by the parties thereto, be endorsed on the duplicate filed in his office.

Refusal to
deliver canes,
or rice.

17. —(1.) Notwithstanding anything contained in this Ordinance, a farmer who has secured an advance shall if the note securing such advance is paid off during the first year from the date thereof be bound to deliver to the holder of such note all the canes or rice, subject to the note, which become ready to be reaped during the whole of such first year, and if the whole or any portion of such advance remains unpaid at the end of the first year or if the farmer fails to deliver the whole or any portion of the canes or rice deliverable by him during the first year from the date of the note, such farmer shall also be bound to deliver to the holder of such note

all the canes or rice, subject to the note, which become ready to be reaped during the second year from the date of such note; and if any farmer refuses or neglects to deliver as hereinbefore provided his canes or rice or attempts or commences to deliver or dispose of such canes or rice otherwise than as hereinbefore provided, the holder of such advance note may by summons before a magistrate call upon the farmer to shew cause why such holder should not be allowed to reap such canes or rice and on proof of the note and of such refusal or default the Magistrate shall, unless good cause be shewn to the contrary, order accordingly.

(2.) On such order being made the holder of the note may enter the lands and cut and gather the canes or rice thereon and after deducting the cost of cutting, carting and delivering such canes or rice to the factory and the amount due on the note, shall pay the surplus, if any, to the farmer.

(3.) Any farmer who shall deliver or otherwise dispose of any canes or rice subject to an advance note, contrary to the provisions of this section or who shall fail or neglect to deliver any such canes or rice to the holder of any such note within a reasonable time of being called upon by notice in writing signed by such holder so to deliver or who shall resist or obstruct the holder of any note acting under any such order as hereinbefore provided, shall be guilty of an offence against this Ordinance and shall on summary conviction thereof before the magistrate be liable to a penalty not exceeding Twenty Pounds.

18. On the application for, or pending the hearing of, any summons as Interim order. in the last section provided, the magistrate may order the farmer to refrain from cutting, gathering or carting away such canes or rice, and any disobedience to such order shall be an offence under this Ordinance and the farmer shall on summary conviction before the magistrate be liable to a penalty not exceeding Twenty Pounds. Every such order as aforesaid shall be personally served, and if for any reason it appears to the magistrate that personal service cannot be effected, he may authorize service to be effected by posting a copy of the order in a conspicuous place on the land.

19. When the factory to which the farmer is to sell his canes or rice is Notice of intention to reap. not the factory of the holder of the note, the farmer shall one week before reaping his canes or rice give notice to the holder of the note of his intention to reap such canes or rice, and in default of giving such notice or if he deliver such canes or rice to any factory not mentioned in the note, he shall be deemed to have committed an offence against this Ordinance and on summary conviction thereof before the magistrate shall be liable to a penalty not exceeding Twenty Pounds.

20. The magistrate may out of such penalty award compensation to be Compensation. paid to any person or persons defrauded by the commission of such offence in the order of the priority of their notes.

21. Any farmer who during the currency of a note and contrary to the Fraudulent dealing with buildings. provisions thereof, disposes of or deals with or attempts to dispose of or deals with any buildings which are subject to such advance note is liable on summary conviction before the magistrate to a penalty not exceeding Twenty Pounds, or to imprisonment, with or without hard labour for a period not exceeding three months.

Failure to
keep lands in
proper condi-
tion.

22. Any farmer neglecting or failing to keep the land, the crops on which are subject to an advance note, in a proper and husbandlike condition, having regard to the purposes for which the advance is in the advance note stated to have been made, is liable on summary conviction before the Magistrate to a penalty not exceeding £20.

Notice to
factory.

23. The holder of an advance note under this Ordinance may give notice in writing in the form in the Schedule hereto to the owner or manager of any factory (not being his own factory) to which the farmer has delivered canes or rice grown on such land as mentioned in the said note, and such owner or manager shall after receipt of such notice not pay to such farmer any sum in respect of the canes or rice delivered until the claim of the holder of the note has been satisfied, or unless such holder consents; and in the event of his so doing without such consent he shall be liable to pay to the holder the amount of such advance, which shall be recoverable by ordinary process of law. On receipt of such notice the owner of such factory may, if the farmer does not consent to such payment being made to the holder of the note or if there is more than one claimant to the money in his hands, pay the amount claimed or any part thereof which is due from him to the farmer into the hands of the Clerk, who shall in such case give a receipt for the same which shall be a full discharge therefor, and issue summonses by way of interpleader to be adjudicated upon by the Magistrate to the several persons alleged to have claims upon the same, deducting in the first instance the prescribed cost of issuing such summonses out of the money so paid in.

Procedure.

24. Except as herein provided, any claim and demand, the amount whereof does not exceed fifty pounds, arising on any advance note between the holder or any person entitled to the benefit thereof and a farmer, shall be heard and determined in the Petty Civil Court of the district where such advance note is deposited, and the procedure in all such matters shall be that prescribed by the Petty Civil Courts Ordinance, 1911.

Appeal.

25. There shall be no appeal from the decision of the Magistrate on any dispute adjudicated upon by him in pursuance hereof, except on a case to be stated by the Magistrate at his discretion.

Repeal.

26. The Cane Farmers' Advances Ordinance (No. 129) is hereby repealed.

Passed in Council this Twelfth day of November, in the year of Our Lord One thousand nine hundred and thirteen.

ALFRED TAITT,
Acting Clerk of the Council.

SCHEDULE.

ADVANCE NOTE.

DISTRICT OF

Lender A. B. of

Farmer C. D. of

Amount secured by this note £

Amount already advanced £

Crop charged : Sugar cane (*or* rice) growing on land of at
comprisingBuildings charged : (*Describe building*)Place at which canes (*or* rice) are to be delivered.Price per ton of canes (*or* rice per barrel of 160 lbs.) delivered at specified
place.

Rate of interest (if any) £ per cent. per annum.

Charges, if any, affecting crops or buildings.

Purposes to which advance to be applied.

We the above-named A.B. and C.D. hereby agree that all canes (*or* rice) which shall be grown and become ready to be reaped prior to the day of 19 (*here insert date of termination of note*) upon the above-mentioned land now the property of (*state name of owner of land*) and also the buildings above set forth shall be pledged by virtue of the Farmers' Advances Ordinance, 1913, as security for the above advance.

Before me

(Sgd.) A. B.

E. F. (C. D.)

Filed this day of by me (J. H., Clerk of the Peace.

NOTICE.

Take notice that I, A. B., being the holder of an advance note dated the day of , made by C. D. in respect of the crop growing on (*describe land*) require that you should not pay to C. D. any sum in respect of the canes (*or* rice) delivered from the said parcel of land until my claim as holder of such advance note has been satisfied.

(Sgd.) A. B.

To X, Z

PUBLICATIONS RECEIVED.

Culture et Exploitation du Caoutchouc au Brésil.—(By M. O. Labroy and M. V. Cayla pp. 1-285 and 105 illustrations. Escriptorio de Informacoes de Brazil en Paris, 191, rue Saint-Honore, 1918.)

It is worthy of note and a striking sign of the change which has taken place as regards the production of rubber, that in this report to the Minister of Agriculture, Industry, and Commerce of Brazil stress should be laid on the cultivation of rubber. It is but a very few years since all the world's rubber was obtained from wild trees and sixty per cent. of the total from the valley of the Amazon. Now rubber from cultivated trees is very rapidly growing in importance, and even in Brazil attention is being directed to the production of rubber under plantation conditions. The opinion of the authors on p. 25 is significant. They regard wild and particularly cultivated *Hevea* as the chief source of the future supplies of natural rubber, and as destined to supplant all other sources; the *Manihots* (*Manicoba* rubbers) as likely to retain a secondary position, but in dry countries; and *Castilloa* as of interest only in places where *Hevea* does not thrive and where labour conditions are difficult.

A resumé is given of the sources of rubber, following which the chief plants are treated in detail.

The species of *Hevea* are described, and an account given of the biology and physiology of *Hevea brasiliensis*. The Brazilian system of collection and preparation of Para rubber is fully dealt with, followed by a description of the commercial varieties, and a summary of statistical and commercial information. Work in other countries, including all phases of estate production, is described with an estimate of expenses and returns.

Other rubber plants of interest in Brazil, the *Manihots* (*Ceara* and *Manicoba* rubber), *Castilloa*, and *Hancornia* are similarly, but more briefly dealt with. The volume is well illustrated.

W. G. F.

Vegetable Fibres.—(*Kew Bulletin*, Additional Series II. Second Reprint pp. 1-280, 1912. Price 8s. 6d.)

This volume contains reprints of articles on vegetable fibres which appeared in the *Bulletin* of the Royal Gardens, Kew, between 1887 and 1898 the year in which it was first issued. Many of the chief fibres of the world are included and also, as might naturally be expected, many comparatively little known which have been the subject of enquiry at Kew. In some cases, e.g., sisal hemp and ramie, the information is very full and is a good summary of the available knowledge at the original time of publication. Although provided with a table of contents, an index would be a useful addition to a subsequent edition as many fibres are referred to in articles the titles of which give no clue to the plants with which they deal.

W. G. F.

Outlines of Stationery Testing.—(By H. A. Bromley, pp. 1-74 Charles Griffin & Co. Price 2s. 6d. net, London, 1918.)

This small treatise is written by an expert, the Assistant Examiner of Paper to H. M. Stationery Office, London, who has evidently first hand knowledge of his subject matter.

To any man interested in the quality of his office materials (and who is not?) this little book should supply a long felt need. Scientific terminology is expressly avoided and a great many simple and practical tests are given, which could be applied by any stenographer guiltless of scientific training. Of such nature for example are the tests given for type-writer ribbon and draughtsman's rubber; scientific testing is however, by any means neglected. Many and satisfactory processes are given for the physical, microscopical and chemical examination of the qualities of various kinds of paper, parchment, vellum, leather, writing inks (black, blue black, coloured, etc.) sealing wax, gum and office paste, string, cord, lead pencils, etc. These tests will be more useful to the analyst than the layman, yet they are described so lucidly as to afford pleasure and profit to any reader. The business man will probably find, however, that his perusal of the book will chiefly be rewarded by the amount of information conveyed as to the composition of various articles of stationery which vary to a surprising degree with the quality of the material and are by no means free from many kinds of sophistication.

Twelve plates illustrate the microscopical features of the raw materials linen, cotton, raw flax, hemp, manilla, pine wool, straw, esparto, mechanical wood, jute, wool. These plates are good and it is unfortunate that the magnifications have not been stated; such terms as "highly magnified" are unsatisfactory.

We are then given an interesting account of the materials (a surprisingly large list) used in loading, sizing and colouring paper, methods dealing with their detection and estimation and standards for quantities permissible. Special papers, parchment, vellum, leather and writing inks of all kinds are next considered and the closing chapters deal with several varieties of sealing wax, gum and office pastes, string, cord and other miscellaneous articles.

H. S. S.

Ornamental Hibiscus in Hawaii. (by E. V. Wilcox and V. S. Holt, *Bulletin* No. 29, Hawaii Experiment Station, pp. 1-60 and 16 coloured plates, 1913.)

This interesting bulletin contains descriptions of 239 varieties of Hibiscus which have been selected as being the most distinctive and valuable of about 500 varieties known in Honolulu. In Hawaii great attention has been given to raising hybrids of this family, and native species have been crossed with introduced forms.

In the West Indies the common hibiscus is *H. rosa-sinensis* whilst *H. schizopetalus* bearing drooping coral-red flowers with deeply cut petals, and *H. mutabilis* the changeable rose are also well known.

Amongst the Hawaiian species are *H. kokia* and *H. kahlili* with red flowers, and *H. brackenridgei* with sulphur yellow flowers; as most of these cross with *H. rosa-sinensis* and *H. schizopetalus* the opportunities for the hybridizer are very numerous and, as the publication indicates, they have been turned to good account.

Practical direction for hybridizing and propagating hibiscus are given as also notes on other matters which will be of much interest to all cultivators of this group of plants.

W. G. F.

NOTES.

Mr. C. H. Wright, B.A., F.I.C., F.C.S., who has been Assistant Analyst and Science Master in the Department of Agriculture since April, 1908, has been appointed by the Secretary of State for the Colonies as Agricultural Chemist in the Department of Agriculture, Fiji. Mr. Wright left to take up his new appointment, on February 17. Mr. A. E. Collens will act as Science Master pending the appointment of Mr. Wright's successor.

Mr. J. B. Rorer, M.A., Mycologist to the Board of Agriculture who has been on leave since September, 1913, returned to the Colony on February, 17.

Interest is being maintained in Agricultural Banks, and during the last three months, Mr. W. G. Freeman has addressed meetings at Princes Town, Couva, Scarborough (Tobago), Arima and San Fernando and explained the objects and mode of working of co-operative credit societies.

His Excellency the Governor was present at the Princes Town meeting.

Local Committees are at work at all these places, they will in due course report to the committee of the Agricultural Society and, it is hoped that a practical scheme will be the result.

The West India Committee Circular of February 10, 1914 gives an account, illustrated with a photograph, of the presentation made to Mr. J. F. Waby on his recent retirement from the post of Head Gardener of the Botanic Gardens, British Guiana, after thirty-five years service.

Previous to taking up his appointment in British Guiana in 1879, Mr. Waby was on the staff of the Royal Botanic Gardens, Trinidad.

On February 14 and subsequent days an Agricultural Show was held at Diego Martin on the property of Mr. E. M. Lazare, Solicitor of Port-of-Spain, who initiated and carried out the scheme. His Excellency the Governor visited the Exhibition on the opening day. The Department and Board of Agriculture co-operated by sending exhibits and giving demonstrations of budding and grafting, and spraying respectively.

Boys of the Reformatory at Diego Martin were present, practically engaged in the various occupations which are taught in the institution, such as wheel-wright work, tailoring, bootmaking, &c.

The Show was a success and it is to be hoped that the example may be followed in other localities, for there is no doubt that district agricultural Shows properly organised are distinctly useful; to ensure the best results, however, it is necessary that they should take place regularly and to secure this some definite organisation is necessary. The recently formed Committee of the Agricultural Society may be able to secure this and it is to be hoped that it will enlist the co-operation of Mr. Lazare and any others who are ready to follow his example.

METEOROLOGY.

RAINFALL RETURN FOR JANUARY, 1914.

Stations.	JANUARY.	
	1914.	1913.
<i>North-west District.</i>		
	In.	In
St. Clair—Royal Botanic Gardens	0.50	2.80
Port-of-Spain—Colonial Hospital	0.41	2.91
" Royal Gaol	0.51	2.89
" Constabulary Hdqrs.	0.68	2.83
St. Ann's—Reservoir	0.49	3.52
Maraval—	0.63	3.84
" Constabulary Station	0.60	4.29
Diego Martin—Constabulary Station... ..	0.43	3.55
" Waterworks	0.86	4.16
" River estate	0.58	3.79
Fort George Signal Station	0.65	2.69
North Post	0.88	2.78
Carenage Constabulary Station	0.63	2.43
Carrera Island Convict Depot	0.82	1.49
Chacachacare Lighthouse	0.84	2.76
<i>Santa Cruz—Maracas District.</i>		
Santa Cruz—Constabulary Station	0.78	5.03
St. Joseph—Government Farm	1.09	3.85
" Constabulary Station	0.58	2.82
Tunapuna—St. Augustine estate	1.16	2.78
Maracas—Government School	1.32	6.34
" Ortínola estate	1.35	5.50
Caura—Wardour estate	1.16	3.66
<i>West Central District.</i>		
Caroni—Frederick estate	5.98	9.62
Chaguanas—Constabulary Station	1.47	4.99
" Woodford Lodge estate	1.56	5.45
Carapichaima—Waterloo estate	1.23	6.94
" Friendship Hall estate	1.24	6.77
Couva—Exchange estate	*	5.09
" Brechin Castle estate	1.14	5.88
" Perseverance	0.93	5.04
" Camden	*	7.62
" Milton	1.01	5.72
" Spring	1.05	6.79
" Constabulary Station	0.84	4.49
" Esperanza estate, Savanatta... ..	0.95	6.23
<i>San Fernando & Princess Town District.</i>		
Claxton's Bay—Forres Park estate	0.88	6.82
Pointe-à-Pierre—Bonne Aventure est.	1.47	7.06
" Concord estate	1.02	7.85
" Plein Palais estate	*	6.74
Naparima—Picton estate	0.64	4.33
" Usine St. Madeleine estate	*	7.23
" La Fortuné estate	0.65	5.09
" Lewisville, San Fernando	1.46	8.05
" Tarouba estate	0.95	5.37
" Union Hall	1.14	4.19
" Palmiste	0.86	5.68
" Hermitage	0.78	4.42
Princess Town—Craignish	1.46	5.75
" Cedar Hill estate	1.94	5.21
" Williamsville estate	3.02	7.41
" New Grant estate	2.44	6.45
" Constabulary Station... ..	0.94	4.97
" Esmeralda Estate	2.04	8.59

* Returns not received.

RAINFALL RETURN FOR JANUARY, 1914.—CONTD.

Stations.	JANUARY.	
	1914.	1913.
<i>San Fernando and Princes Town District.—(Cont'd.)</i>	In.	In.
Princes Town—Hindustan estate	1·61	5·97
„ La Retraite estate	4·70	7·51
„ Malgretoute estate	1·55	5·35
Savana Grande—Friendship and Ben Lomond estates	1·35	5·93
Poole—El Rosario estate	1·79	11·02
<i>Montserrat District.</i>		
Montserrat Constabulary Station	1·39	8·39
Brasso—La Vega estate	2·86	7·81
<i>Arima District.</i>		
Arima—Warden's Office	1·88	2·34
„ Torrecilla estate	2·32	4·56
„ Verdant Vale estate	1·69	4·68
San Rafael—Constabulary Station	1·92	7·77
Guanapo—Talparo estate	1·77	6·53
Tamana—Sta. Marta estate	2·79	7·18
<i>South-west District.</i>		
Oropuche—Constabulary Station	0·85	5·22
„ Pluck estate	0·34	4·97
Siparia—Constabulary Station	2·15	6·96
Guapo—Adventure estate	0·75	5·09
Cap-de-Ville—Constabulary Station	1·69	6·35
Erin—La Ressource estate	2·23	4·64
„ Industry estate	2·86	...
Cedros—Constabulary Station	1·97	3·57
„ Perseverance estate	1·78	...
Icacos—Constance estate	1·24	5·80
Irois—Irois estate	2·17	5·17
<i>South Coast.</i>		
Moruga—Constabulary Station	1·48	7·27
<i>North Coast.</i>		
Blanchisseuse—Constabulary Station	1·58	11·00
Grande Rivière—Mon Plaisir estate	2·60	14·01
Toco—Aragua House	2·23	12·20
„ —Constabulary Station	1·74	12·35
Point Galera—Light House	0·59	7·11
<i>East Coast.</i>		
Matura—La Juanita estate	2·20	10·71
Manzanilla—Constabulary Station	2·82	10·41
Sangre Grande—Sta. Estrella estate	4·22	9·46
„ New Lands estate	3·55	12·91
„ Evasdale estate	3·12	7·74
„ Grosvenor estate	2·55	8·57
Mayaro—Constabulary Station	1·72	11·39
<i>Tobago.</i>		
Tobago—Hermitage estate	3·29	9·83
„ Riversdale „	1·38	6·63
„ King's Bay „	3·46	9·52
„ Roxburgh	3·49	11·45
„ Lure estate	4·55	9·75
„ Botanic Station	2·28	5·07
„ Government Farm	0·98	2·99
„ Lowlands estate	0·98	4·22
„ Friendship estate*	1·46	5·01

BULLETIN

OF THE
DEPARTMENT OF AGRICULTURE,
Trinidad and Tobago.

VOL. XIII.]

MARCH-APRIL, 1914.

[No. 79.

CACAO.

CULTURAL SKILL IN TRINIDAD AND THE GOLD COAST.

IN September, 1913, an article (given below) appeared in the *Philippine Agricultural Review*, the official journal of the Philippine branch of the United States Department of Agriculture. This article was reproduced in the *Tropical Agriculturist*, the journal of the Ceylon Agricultural Society, edited by the Department of Agriculture of that Colony and has since been published in and endorsed by the *Port-of-Spain Gazette*.

The chief point of immediate interest is the comparison drawn between the cultural skill of the Gold Coast and the Trinidad cacao cultivator—much to the disadvantage of the latter. The original article having appeared in two influential tropical agricultural journals, and been accepted by one of the principal newspapers of this colony it seems desirable to draw attention to certain inaccuracies which vitiate the conclusions arrived at, as it might be prejudicial to the interests of the Colony if the idea were allowed to gain currency that Trinidad is behind the Gold Coast so far as skill in cacao cultivation is concerned or that the recent drop in exports is due to lack of cultural skill or to severe fungoid disease.

In the *Port-of-Spain Gazette* of January 10, 1914, there appeared in the column usually devoted to editorial contributions the following article :

"PHENOMENAL RESULTS OF APPLICATION OF SCIENTIFIC HORTICULTURAL METHODS WITH CACAO GROWING IN WEST AFRICA."

"One sometimes hears sarcastic and unkind remarks made by persons in these islands against what they term *only gardening*. Such individuals apparently are behind the times in coming to such erroneous conclusions, and if the cacao-planter wishes to be an up-to-date man, he must keep in touch with and adopt what scientific horticulture teaches, otherwise he will be left in the lurch. In fact that is what has happened in the main with our own island, and it would have been to the advantage of Trinidad, if she had thrown over board long ago her old, conservative methods and recognised the solid fact that Horticulture means something more than growing beautiful roses, orchids and palms, for instance; and that it teaches how to grow cacao to perfection. Herewith is an extract taken from the November issue of last year of the *Ceylon Tropical Agriculturist* about cacao, and to us it appears to be a very important,

and a most significant statement indeed, as it speaks volumes in favour of the *trained scientific worker*: It runs thus:

“CACAO: THE WORLD'S CACAO PRODUCTION:

“Scientific horticulture and careful attention to field methods have seldom shown more striking results than in the case of the Gold Coast cacao industry. In 1910 this country ranked fourth among the world's greatest cacao producers but it now far excels even Ecuador which was until 1911 the only rival San Thomé had for first honours. Bad practices and fungus diseases are surely telling on the San Thomé crop; although extension of area has been going on, the crop of 1912 was considerably less than for 1910 (36,665 tons).

“With very little noise or advertisement, the ~~great new cacao country~~ of the Guinea coast has leaped to first rank and will ~~probably hold this~~ place for many years to come. In 1910 only some 23,000 tons were produced; the 1911 crop was nearly double this.

“Southern Nigeria, a near neighbour of the Gold Coast, is rapidly developing the cacao industry, the crop for 1911 being an increase of nearly 50 per cent. over 1910.

“Brazil, as was expected when she began her cacao planting some ten years ago, has forged to the front and now ranks as fourth in the 1912 list.

“*Trinidad, British West Indies, has been suffering for some ten years with a combination of bad cultural practices, absurd over-shading, and a very severe fungus disease. The production for 1910 was over 26,000 tons, but for 1912 was less than 19,000 tons, (italics ours).*” (1)

“According to the *Gordian* of Hamburg, the total production of the world is at present about 230,000 tons, worth in bulk about 150 millions pesos.—*Philippine Agricultural Review*. September 1913.”

The general trend of the article is that the cacao planter of this colony should pay greater attention to his cultivation and that if he did so he would secure larger crops. To this no one will take exception, and there are noteworthy examples in both Trinidad and Tobago of planters who do pay the most careful attention to all phases of their cacao cultivation and who undoubtedly are rewarded for their skill and their labour. But is the general planting skill of the Trinidad and Tobago cacao planter so far behind that of the Gold Coast cultivator as the writer in the *Philippine Agricultural Review* suggests?

Let us look a little more critically at his contribution. A sharp contrast is drawn between Trinidad and the Gold Coast. It is stated, and correctly so, that whilst the output of cacao from the Gold Coast has increased largely since 1910, that of Trinidad during the same period has decreased.

The explanation offered is that the Gold Coast industry has advanced owing to “scientific horticulture and careful attention to field methods” whilst the diminution in the Trinidad output is presumably attributed to the “combination of bad cultural methods, absurd over-shading and very severe fungus disease” as no other cause is referred to.

(1) i.e., *Port-of-Spain Gazette*. (Ed.)

The growth of the Gold Coast cacao industry is one of the striking developments of tropical agriculture of recent years ; it is very instructive to compare the exports of cacao from that colony with those from Trinidad and Tobago for a longer period than does the writer of the article in the *Philippine Agricultural Review*.

TRINIDAD AND TOBAGO		GOLD COAST.	
Year.	Cacao Exported. lb.	Year.	Cacao Exported. lb.
1903-04	36,154,048	1903	5,104,761
1904-05	40,753,776	1904	11,451,458
1905-06	48,416,256	1905	11,407,608
1906-07	27,570,928	1906	20,104,504
1907-08	49,730,576	1907	20,950,400
1908-09	49,137,088	1908	28,545,916
1909	51,575,104	1909	45,277,606
1910	57,858,640	1910	50,692,949
1911	49,790,832	1911	88,987,324
1912	41,525,627	1912	86,197,151
1913	48,116,377	1913	

The table shows that within ten years the exports of cacao from the Gold Coast have risen from five to nearly ninety million pounds, whereas during the same period Trinidad's increase has only been from thirty-six to nearly fifty-eight million pounds in 1910 the record year.

The facts regarding the exports from the two colonies since 1910 are, as already stated, correct. The question now arises is the explanation equally correct, namely that the Gold Coast increase is due to scientific horticulture and the Trinidad decrease to bad cultivation, over-shading and severe fungus disease.

It so happens that 1910, the year taken for comparison is, as already shown the year of the record cacao crop for this colony. It also happens that since 1910, the colony has experienced a succession of dry seasons : the droughts of 1911-12 and to a less degree 1913 have been amongst the most severe experienced in the colony since cacao cultivation was taken up on a large scale. The disastrous effects of these years on the crop are only too well known locally but it will be well under the circumstances to give the comments of the Wardens in their Annual Reports for 1912-13 (*Council Paper* No. 18 of 1914) :—

Arima.—The cacao crop was again a short one owing to the excessive drought of the previous year.

Couva.—Cacao cultivation in Couva is more or less of a negligible quantity, and the damage done to it by the drought of 1912 was very considerable.

Chaguanas.—The sugar and cacao crop were short as a result of the drought—although better results were obtained than had been anticipated.

Manzanilla.—Owing to the severe drought the cacao crop was less than that of last year by over 1,000,000 lb. plus the natural increase, which as this is to a very large extent a growing district would mean a very large amount.

Mayaro.—No comment.

Montserrat.—The quantity of cacao, the principal product of this Ward, reaped during the year, was 5,534,761 lb., or 33,544 bags of 165 lb., being 3,468,280 lb. short of the previous year's crop which was 8,993,041 lb. The decrease in the crop is attributed to the effect of the severe drought which did considerable damage to most of the estates in the district.

Naparima.—No comment.

Oropuche and La Brea.—The cacao crop was a short one owing to the effect of the severe drought experienced during the past year.

Savana Grande and Moruga.—The terrible drought experienced from January to June, 1912 was the worst known to any of the oldest inhabitants.....Cacao was 3,058 bags short, due no doubt to the severe drought.

St. Ann's and Diego Martin.—The drought of 1912 will long be remembered as one of the severest for many years. The losses entailed on cultivation—especially cacao—were very severe but to all this I referred in my last annual report.

Tacarigua.—There was a great falling off of the cacao crop due to the drought, it being impossible to obtain reliable information in connection with this crop I have estimated it at 25,210 bags of 165 lb. realizing the sum of £110,293 15 0, as against 42,000 bags for the previous year. It will take another year or two for the cacao trees to recover full strength and vigour, and a considerably longer time to replace the missing trees.

Tobago.—The prolonged drought of 1912 has necessarily caused a considerable decrease in the export figures for the year under review, but it is probable that this island has suffered less than most districts in Trinidad.

Toco.—The severe drought which commenced in the latter part of January, 1912 and continued without break up to the middle of May was not in this Ward productive of such serious injury to crops as was at one time anticipated. Perhaps there was more than appeared at first blush in the contention of some local planters of experience that here at least the drought was in effect more beneficial than otherwise since it relieved the soil of accumulated moisture to which partial failure of crops during previous years was due. The cacao crop was the heaviest for many years and would have been better had not very unfavourable weather conditions prevailed during the early part of January.

It will be evident that no deductions of any scientific value can be drawn, as to the degree of horticultural skill employed by the Trinidad planter, by making comparisons between the crops of his record year, 1910, and those of some of the driest seasons of the last half century. How seriously the climatic conditions of these years affected the crops on an individual estate may be seen from the results given below of fields at River Estate. I have taken River Estate as an example, because being under the management of the Department the full data are readily accessible to me. They have already been published up to March 31, 1913 with a diagram, in the *Annual Report for 1912-13 (Special Bulletin, Department of Agriculture, p. 45)*.

FIELD.	Age of trees.	CROP IN BAGS (165 LB. PER 1,000 TREES.)					
		Years.	1909-10.	1910-11.	1911-12.	1912-13.	1913-14.
1	12	11.75	12.80	10.45	11.18	11.52	
2	30	15.37	21.03	13.07	7.07	11.35	
3	30	19.41	23.09	13.16	7.93	11.81	
4	30	17.43	17.57	20.00	13.94	17.47	
5	30	19.29	20.85	19.19	15.16	18.48	
6	30	5.58	10.65	12.18	9.31	11.66	
7	8 to 80	8.00	7.99	4.93	5.01	5.28	
8	8 to 30	10.74	16.33	14.77	11.65	13.69	
	Rainfall Apr.-Mar.	84.9	66.51	57.50	66.53	61.63	

On Nos. 1 and 6 of the Fields manurial experiments have been in progress during this period. In Field No. 1 the trees are at an age when their crops in normal years are rapidly increasing; yet even with these and under special manurial treatment the yield has fallen. In Fields 2 to 6 the trees are all about the same age and in each case there is a fall, and in most a heavy fall in the crops of 1911 and 1912 as compared with 1910. Obviously trees which were giving about twenty bags per 1,000 (approximately 1,000 lb. of cacao per acre) cannot have been in very bad cultural condition, absurdly over-shaded or very severely affected by disease; yet their yield has fallen as indicated above during the years for which the comparison is made.

Nor are figures such as these the only ones to rely on. When the criticism was made only the output for 1912 was available. That of 1913 is now known and Trinidad has not continued to decline. With an improvement in climatic conditions the cacao crop has likewise improved and the exports for 1913 are some 6,500,000 lb. or approximately 3,000 tons, in advance of those of 1912. This advance which is general for the Colony is well shown in the above table of the River Estate fields, although it will be seen that some fields have not yet regained their former standard. The Philippine critic may from this draw the conclusion that the Trinidad planter has since 1912 improved his cultural methods,

reduced his shade or successfully combated with disease, the fact will remain, however, that as in the previous comparison, the rainfall has been a predominant factor and this he has entirely ignored in drawing his conclusions.

Now let us turn to the statement: "Scientific horticulture and careful attention to field methods have seldom shown more striking results than in the case of the Gold Coast cacao industry" and consider whether this in a well-founded conclusion. A useful summary of information on the Gold Coast industry is contained in *The Agriculture and Forest Resources of British West Africa* (1911) by Mr. G. C. Dudgeon, now Director General of Agriculture in Egypt and formerly Inspector of Agriculture for British West Africa. He says (p. 43). "Native plantations are for the most part formed of irregular lines of trees generally planted too closely."..... Until the ground is so shaded that the cultivation is kept naturally more or less clean, "the cutting of weeds is an operation which may have to be performed twice, or even three times in the year. This is the only form of cultivation given, no manure being used or any breaking of the soil done."

There is little evidence of the application of any special horticultural skill here, nor in the following extracts from the same source relative to pruning, picking, etc. In fact Mr. Dudgeon is careful to contrast the crude methods in vogue in the Gold Coast with the superior skill exhibited by the West Indian cacao planter.

"PRUNING in the West Indies, is attended with the greatest amount of care, and is performed for the purpose of producing a vigorous tree by the removal of all useless wood, and of encouraging fruiting branches to increase their production. In order to do the latter it is essential to remove any superfluous number of primary branches, three or four being considered sufficient for one tree. A similar regulation of growth is required with regard to the secondary and tertiary branches. In addition to this, care is given to retain the correct balance for the tree, and, when cutting out branches to avoid making jagged cuts or slashes. The West African native does not prune with these objects in view, but employs a cutlass or machete to cut out those branches which seem to be giving too much shade or which have become interlaced, regardless of their value to the tree or of the wounds inflicted in the operation. Efforts have been made to teach pruning at the Botanic Stations, but the demonstrations have not been largely attended, and a great deal of damage continues to be done through ignorance of the objects and efforts of pruning. Many of the older plantations, owing to bad treatment and too close planting, are yielding an annually diminishing crop, but new ones are springing up in increasing numbers each year, which is an obvious indication that the industry is proving a profitable one.....

"HARVESTING AND PREPARING.—The native cacao grower collects the pods from his trees at the time when he estimates he can gather the most, and, in consequence, many over-ripe and under-ripe fruits are taken with the ripe. The effect of this is to give an irregular product which can never possess the attributes of a good cacao. The pods are usually pulled off the tree, a knife being seldom used; and in the action of pulling off, the cushion, upon which the pod is borne, is often torn and injured.

As it is from this point, or near it, that the successive crops of flowers and fruits proceed, the bearing power of the tree is frequently diminished in this way. The use of a knife and the necessity for frequent pickings, to ensure the pods being taken when mature, are among the most important lessons which the native planter should be taught..... ..

"The skilled cacao planter of the West Indies and Ceylon is careful to pick only those pods which are quite mature, and, in order to do this, he is obliged to go over his plantation frequently. Mature pods are those which have assumed a yellowish or reddish colour, and considerable experience is necessary to judge this with accuracy. The pods are removed by means of a cutting instrument called a cacao hook with which care can be more easily given to the preservation of the cushion."

The Gold Coast Department of Agriculture is making great efforts to improve methods both of cultivation and of preparation. A staff of Travelling Instructors is maintained whose work is more or less similar to that of the Agricultural Inspectors in the Cacao Prize Competition of Trinidad. In his *Annual Report* for 1911, the Director, Mr. W. S. D. Tudhope writes :

"The instruction given followed that summarised in my last annual report. About 400 small model cacao farms have been formed by the Instructors in the districts visited. Inasmuch as these farms demonstrate the precepts of the Instructors they serve a useful purpose at the time they are made, but I regret that on repeated visits it is found a large number of them have not received sufficient attention from the owners in the intervals, the final object is thereby greatly frustrated. During the current year this method of demonstration is being extended and other products are being established on stool lands at several of the Omanhenes' (Head-Chiefs) headquarters. It is hoped ultimately to have such a farm established under well-nigh every Omanhene, and that this will do much to encourage the people in better methods of cultivation.....While itinerant instruction has been the means of a considerable improvement in the condition of the farms and of the preparation of cacao, much yet remains to be accomplished. A larger number of Instructors should be employed to allow of more frequent visits being paid to the same districts. At present owing to the extensive area allotted to each Instructor repeat visits can hardly be arranged within the year."

The Travelling Instructor in his report for the same year says : "The Native Instructors are well received by the Chiefs and farmers ; and there are very few now who have not had an opportunity of benefiting by their instructions. But while considerable progress has undoubtedly been made there is still great room for improvement in the care of farms, &c. The cacao trees are planted too close together, and little care is taken to select good pods for seed purposes. The empty cacao husks are not buried, and diseased and squirrel eaten pods are frequently left until they fall off the trees. Except during the harvest season, many of the farms are allowed to become overgrown with high weeds ; pruning is carried out in a very crude manner, and while cutting the pods from the trees is now more general some are still torn off. Some well kept farms, however, were seen in all parts of the Colony and Ashanti

"Cacao cultivation is rapidly extending and even in the outlying districts new plantations are being made, which make it apparent that a satisfactory profit is being obtained. The quality of the product generally shows a marked improvement. The poorest quality seen was in the Agona district of the Central Province where the bulk of the produce at the beginning of the season was being offered for sale in a very wet condition. The best prepared cacao was seen in the Eastern Province of the Colony, and the Southern Province of Ashanti. The natives frequently allow the pods to become over-ripe before they are plucked, which not only reduces the quality of the product, but encourages insects and fungoid pests on the plantations. Where germinated cacao was seen the Chiefs were instructed to have it destroyed, and several loads of germinated and musty cacao being dried ready for sale, were, on my advice, destroyed."

The *Annual Report* for 1912 of the Gold Coast Department of Agriculture presents a very similar state of affairs and also indicates that owing to neglect of proper plant sanitation there is a danger of outbreaks of disease.

Mr. Tudhope writes:

"Cacao, even at the comparatively low prices now being received in the remote districts, is undoubtedly a very lucrative cultivation for the natives of this country and it is evident that the area under cultivation is being extended in every part of the forest country. Already signs are everywhere apparent that there is very grave danger of the farms being extended beyond what might be reckoned reasonable limits; resulting in neglect or inability to maintain the plantations in a cleanly and healthy condition thereby threatening the whole industry with disaster.

"Bye-Laws having for their object improvement in the condition of farms were promulgated two years ago and have been adopted by the majority of the Chiefs in the Colony, but they remain practically a dead letter; and it is worthy of serious consideration whether legislation should not be introduced on the subject.

"Plants on the younger farms are being placed at better distances apart and many of the more intelligent farmers are now preparing a better quality of cacao but generally speaking the care of the plantations, treatment of the trees, and the preparation of the product leaves much to be desired, and the natives do not yet realise the dangers attendant on their lax methods but seem content to jog along in their own way."

"The area under cacao cultivation was largely increased, many new farms being opened up during the year and there is every sign of much further extension. Many enquiries are made for the Cundeamor cacao, and plots of this variety are now being established.

"Some of the farmers have stopped planting up new areas, and are devoting more attention to the established farms.

"Thinning out and careful pruning of the trees are being generally observed by a number of the literate natives and the trees are being planted at better distances apart, but there are still many farms in a very neglected condition which are a great source of danger to the industry.

"In the more exposed districts the new established plantations suffered considerably through drought and many of the young trees died

out, but the older established plantations did not appear to suffer to any great extent although many of the trees were defoliated."

The conclusion which must be drawn from the reports is that the present magnitude of the Gold Coast cacao industry is by no means due to "Scientific horticulture and careful attention to field methods." It is essentially due to the natural advantage of large suitable areas and cheap labour. The officers of the Gold Coast Department of Agriculture have done and are doing excellent work but at present they are dealing with cultivators who as regards skill in cacao cultivation are far behind the average cacao planter of Trinidad.

That this is so only makes it more imperative that every effort should be made, by good cultivation and attention to the general health of the plants, to increase the yield per tree and per acre in Trinidad. The Gold Coast has achieved wonders in comparatively few years in spite of all the defects in methods noted in the official reports, she will be a more formidable competitor still when means of transport have been more fully developed and when "scientific horticulture and careful attention to field methods" are actually practised by the mass of her cacao cultivators.

W. G. FREEMAN.

GENERAL CONCLUSIONS ON THE MANURING OF CACAO IN DOMINICA.

Mr. H. A. Tempary, Superintendent of Agriculture in the Leeward Islands includes the following interesting summary on the manuring of Cacao in the *Report on the Agricultural Department, Dominica for 1912-13* :—

Manurial experiments with cacao have been systematically conducted both at the Botanic Gardens and in country districts in Dominica during the past eleven years. It is believed that the accumulated results now enable sound deductions to be drawn regarding the manuring of cacao under these conditions.

The principal fact which stands out is the value of natural organic manures either in the liberal application of pea manure or compost.

There does not appear to be any room for doubt that methods of manuring based on this principle are those most likely to give satisfactory results under the conditions in question.

It may again be pointed out however, that good results can only be expected to accrue from this or any other form of manuring if due attention is also paid to the requirements of the trees in other directions such as general care, pruning, sanitation, and on heavy soils, drainage; it is further to be remembered that it is not all localities in Dominica which are suitable for cacao cultivation.

Having regard to these points it seems to be the soundest policy for cacao growers to endeavour to raise large quantities of organic manure for application to their orchards.

Difficulties of transport are frequently urged as an argument against the utilisation of the abundant supplies of material for mulching available in the forests of Dominica, the view may however be expressed that if full use were made of readily available material and if this were systematically combined with the utilisation of such stock as exist on the estate and the raising of leguminous and other crops as additional material for mulching, the problem would not be far from being solved in many cases.

When sufficient organic manure is not available to supply a complete manuring it should be supplemented by artificial manures which should always contain nitrogen and phosphate. Nitrogen is best given in some form in which the constituent becomes slowly available, such as tankage, dried blood, or cotton seed meal. Rapidly acting forms of nitrogenous manure such as nitrate of soda and sulphate of ammonia and nitrate of lime are of more especial value when it is desired to give a strong stimulant to trees that are in an unsatisfactory condition.

Calcium cyanamide or nitrolim continues to attract a certain amount of attention as a possible nitrogenous manure in cacao cultivation and although no very definite information is available concerning this manure the fact that its nitrogen becomes available with relative slowness and that it possesses a high content of lime indicates that it may be of value in cacao cultivation under these conditions.

Basic slag appears to be the most suitable form in which to apply phosphoric acid largely by reason of the considerable excess of lime which it contains.

There is no separate evidence available to show the effects of potash, but the majority of Dominica soils are well supplied with this constituent and there is nothing to lead us to believe that applications are likely to be of value.

It is a characteristic feature of Dominica soils that they are deficient in lime, and although trials of this substance have not been included in the experiments so far conducted there is ample internal and collateral evidence to show that applications of lime are likely to be of marked benefit if given in conjunction with suitable manurial applications.

FIELD NOTES.

PRUNING.

There is much diversity of opinion with regard to correct pruning; which branches to remove, which to leave is a problem that still remains unsolved; most planters agree that trimming of some sort is necessary, some believe that the tree must be given a good shape and proper balance.

This is sound enough reasoning, but there is an essential point that has not been cleared up, namely: What is the correct shape? Should a tree be too heavy on one side, we reason in a sound manner, that that side should be lightened to give the tree a proper balance, but with regard to shape the planter often errs in shaping the tree irrespective of conditions, in consequence too much healthy bearing wood is removed. Any branch is capable of producing fruit; and the little whips and small branches protect the tree in several ways, chiefly by giving to the plant a larger area of foliage, which means that greater manufacture of plant food takes place.

Leaves are absolutely necessary to the health of the tree, for a plant is largely dependent on food made through the activity of the leaves. Separation of carbon from carbonic acid gas of the air is effected in the green cells of the leaf. During daylight the carbonic acid gas is decomposed, carbon retained and oxygen set free. Respiration also takes place through the leaves—they are, so to speak, the lungs of the tree.

Without a sufficient leaf area there is the possibility that an adequate supply of plant food may not be available to meet the requirements of the crop and that many of the young pods will accordingly die. Excessive pruning also causes a drain on the food supply owing to the cambial activity which ensues after cutting.

I mention these points not because I think a cacao tree should not be touched at all—on the contrary; I believe that proper, light pruning, and at the proper time is necessary—but that more thought and study may be given to this important work.

REST IS NEEDED.

I have been privileged to ride over a large estate where the "rest cure" has been applied to the cacao trees, and was astonished at the results. The health of the trees, the dark green colour of the foliage and the quantity of healthy fruit of all sizes would gladden the heart of any planter.

I saw new wood, an abundance of it, I saw the little whips and small branches laden with fruit, one delicate whip, scarcely eighteen inches long, contained six large, healthy pods. Did the new wood, renews, palm branches, etc., produce fruit? I observed that the new wood really contained more fruit than the old parts of the trees. Healthy renews, two and three to each tree, held bunches of pods of all sizes from stem to tip, and most of them had outgrown the mother! Nor was I taken to a particular field—we went over the entire estate, riding steadily for four hours, and the conditions were alike in every field.

"Have you improved your yield by this method?" I asked the manager? "Doubled it in four years," he answered quietly, "and this crop will be the largest on record!"

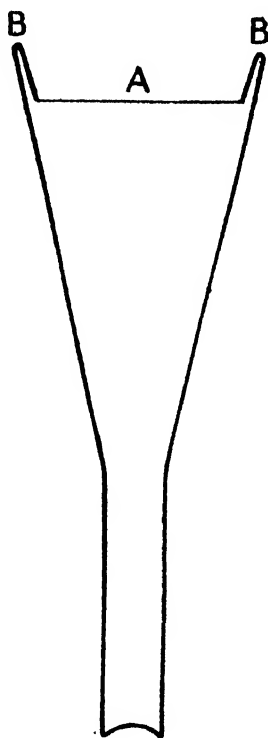
A USEFUL TOOL.

All excessive "chupons" have been removed, but this modern manager used a little tool made by himself that has a decided advantage

over the pruning knife and poniard. This useful knife is placed close up to the junction of the "chupon" or branch to be removed, and with one stroke of a mallet the branch is severed, giving a clean, close cut. In the case of a branch out of reach the knife is attached to a rod in the same manner as the picking knife, and the hammer used quite as effectively.

A sketch of the knife is given below :

D. C. PLUMMER.



Pruning Knife

A. Cutting edge

B. Blunt points

PERMITS TO CUT WILD CHATAIGNE TREES.

For Cacao Beetle Traps.

The use of "traps" consisting of pieces of wood of the wild chataigne tree (*Pachira aquatica*) was recommended in Circular No. 1 of the Board of Agriculture on *The Life History and Control of the Cacao Beetle* by Mr. P. L. Guppy. Such traps have since been used in various parts of the Colony. It sometimes happens however that the tree does not occur on the estate and the Forest Officer recently received an application to cut a tree on Crown Lands for the purpose of making traps. Mr. Rogers then requested authority of His Excellency the Governor to authorize Wardens to grant free permits for cutting wild chataigne trees on Crown Lands, stating in support of his recommendation:—

"During the last ten years, no wild chataigne tree has been cut under license and the tree is valueless, except for making traps for cacao beetles. Moreover, the trees form a breeding place for the beetles and so are a source of danger to adjoining cacao plantations. Owing to financial reasons it is impracticable for this Department to cut out all the trees and if this were done the felled trees would promote an immediate increase in the pest of cacao beetles by providing an immense breeding ground of a most favourable nature which would be far more dangerous than the living trees.

"The price of wild chataigne trees is 16 cents for a tree not exceeding 3 feet in girth and increases at the rate of four cents for each extra foot of girth, so the loss in revenue is immaterial."

The following circular has since been issued to the Wardens:—

"In accordance with instructions received from His Excellency the Governor, I hereby authorise you to grant free permits for the cutting of Wild Chataigne trees on Crown Land not included in a Forest Reserve. Inside the Forest Reserve the license will be granted by this office.

"The permit may be in the nature of a letter, as it is unlikely that so many will be applied for as to make it worth while to print licenses. The trees should be stamped on the stump either before or as soon as convenient after the trees have been cut. It will not be necessary for a Forest Ranger or Ward Officer to spend a day specially for the purpose.

"Will you kindly make this concession of His Excellency known in your district."

(Sgd.) C. S. ROGERS,
Forest Officer.

EXPORTS OF CACAO AND SUGAR 1891-1912.

The accompanying diagrams, reproduced by permission from the last *Annual Report* of the Collector of Customs, afford at a glance an interesting summary of the total export trade in the two principal agricultural products of the Colony and of the direction of that trade from the period 1891 to 1912.

In the first diagram, which deals with values, it will be noted that during the twenty years from 1891 to 1910 the annual average value of the exports of cacao during the five year periods increased from £550,000 to £1,200,000, and fell during the dry years 1911 and 1912 to an average value of about £1,110,000.

Sugar during the same period has decreased in value from about £650,000 to a little under £500,000.

The actual figures are as under:—

TOTAL TRADE. SUGAR AND CACAO.

PERIOD.	SUGAR.	CACAO.
1891-5 ...	£8,290,498	£2,753,886
Annual Average ...	658,097	550,877
1896-1900 ...	3,104,070	3,321,467
Annual Average ...	620,814	664,293
1901-2 to 1905-6 ...	2,472,240	4,580,765
Annual Average ...	494,448	916,153
1906-7 to 1910 ...	2,702,431	6,102,266
Annual Average ...	540,486	1,220,453
1911 and 1912 ...	969,887	2,135,362
Annual Average ...	484,944	1,067,681

In the diagram which indicates the direction of the trade in cacao the chief features is the rapid development of trade with the United States of America, whilst as shown in the following diagram there has during the same period been more than equally rapid fall in the export of sugar to that country. In sugar there has been a large increase in trade with British North America, *i.e.* Canada the annual average of which in 1906-1910 slightly exceeded that with Great Britain.

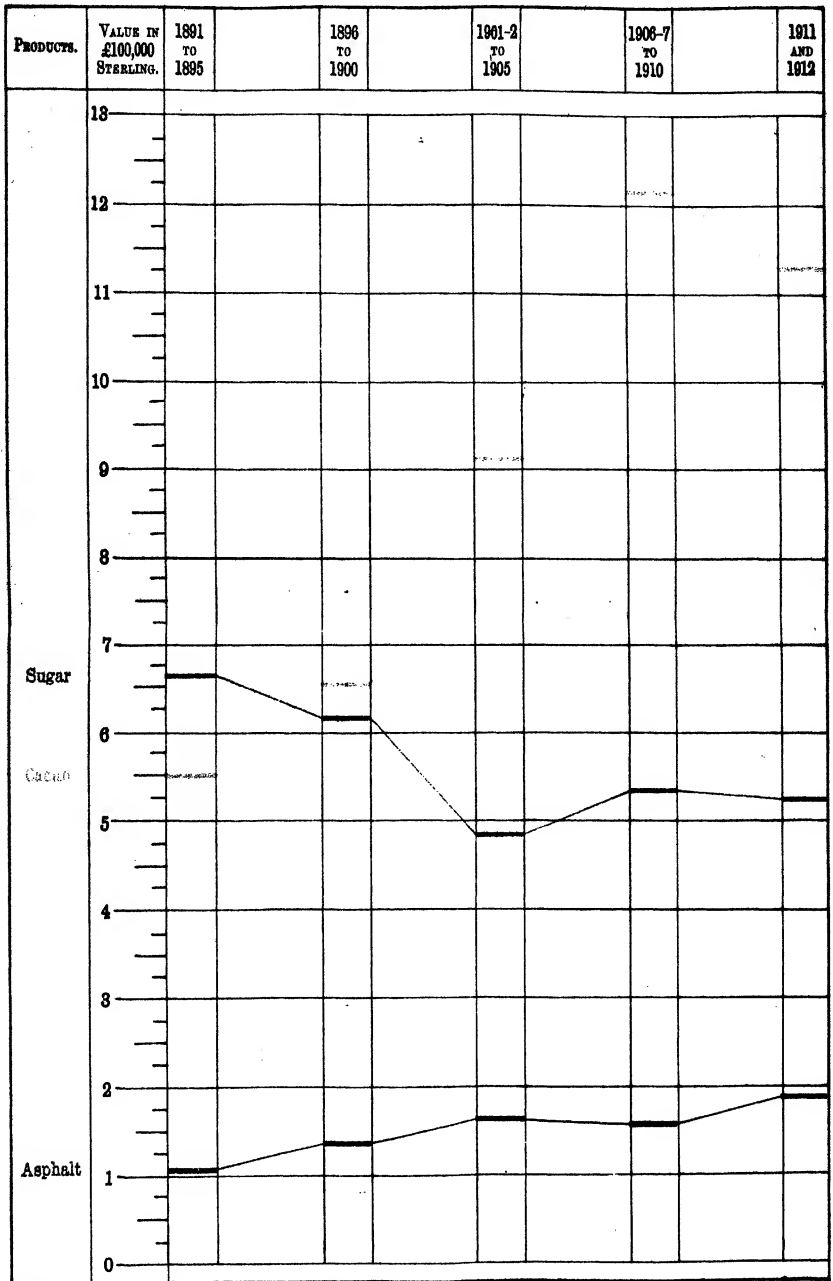
DIRECTION OF TRADE IN CACAO.

PERIOD.	GREAT BRITAIN.	B. N. AMERICA.	U. S. AMERICA.	FRANCE.	OTHER COUNTRIES.
<i>In Million pounds weight.</i>					
1891-5 ...	37.2	38	26.1	44.9	2.23
Annual Average ...	7.4	0.7	5.2	9	4.5
1896-1900 ...	46.2	98	83.8	46.1	4.22
Annual Average ...	9.2	19	6.7	9.2	8.4
1901-2 to 1905-6 ...	41.3	185	72.3	70.6	6.85
Annual Average ...	8.3	37	14.5	14.1	1.37
1906-7 to 1910 ...	27.3	20	103.6	90.9	12.4
Annual Average ...	5.4	4	20.6	18.2	2.5
1911 and 1912 ...	9.4	7	50.6	21.2	9.4
Annual Average ...	4.7	3	25.3	10.6	4.7

DIRECTION OF TRADE IN SUGAR.

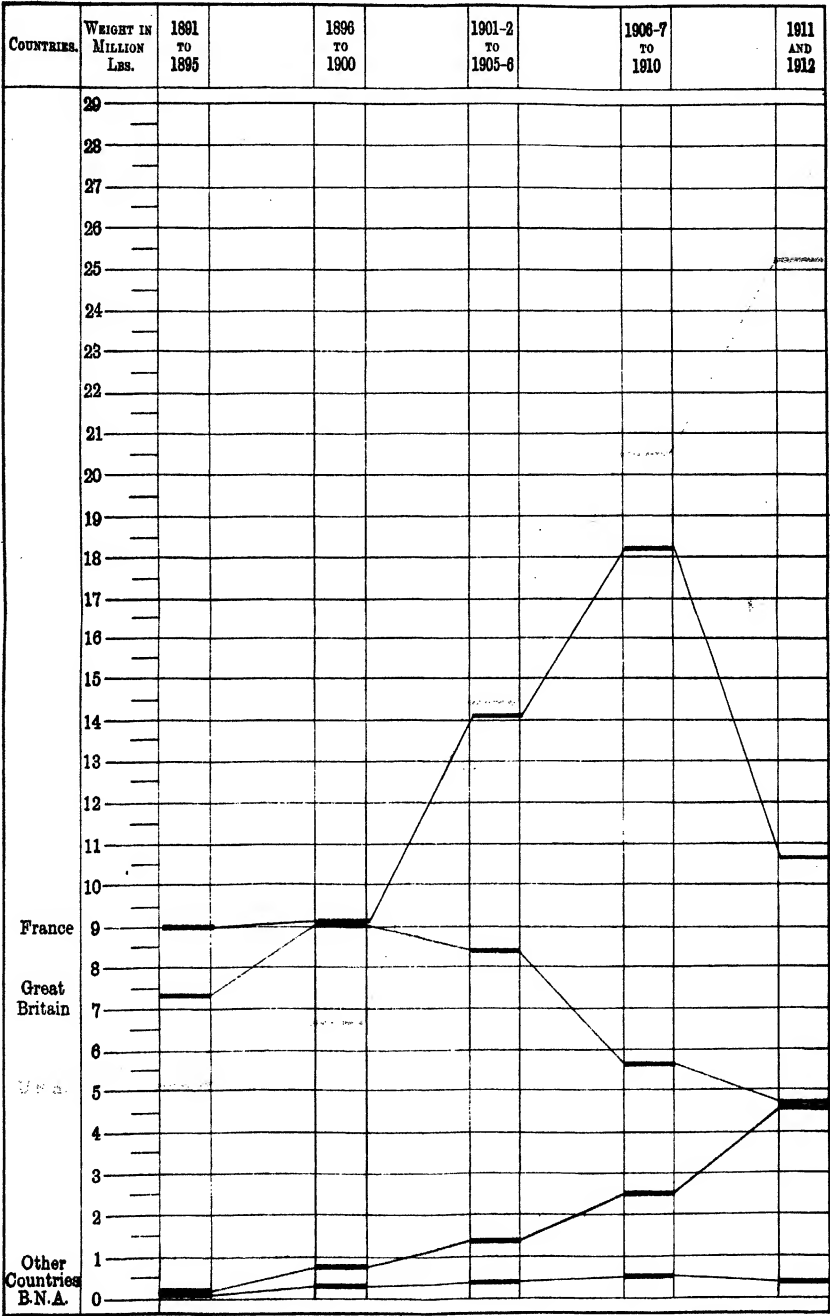
PERIOD.	GREAT BRITAIN.	B. N. AMERICA.	U. S. AMERICA.	OTHER COUNTRIES.
<i>Tons.</i>				
1891-5 ...	107,358	1,637	131,865	508
Annual Average ...	21,471	327	26,378	102
1896-1900 ...	119,950	3,405	120,450	2,963
Annual Average ...	23,990	681	24,090	593
1901-2 to 1905-6 ...	122,217	38,088	54,261	2,150
Annual Average ...	24,443	7,618	10,852	430
1906-7 to 1910 ...	109,735	110,457	1,465	815
Annual Average ...	21,947	22,091	293	163
1911 and 1912 ...	41,559	22,989	2,680	3,874
Annual Average ...	20,780	11,495	1,340	1,937

Average Annual Values of the Principal Local Products exported during each of the Quinquennial Periods 1891-5, 1896-1900, 1901-2, to 1905 6, 1906-7 to 1910, and the years 1911 and 1912.



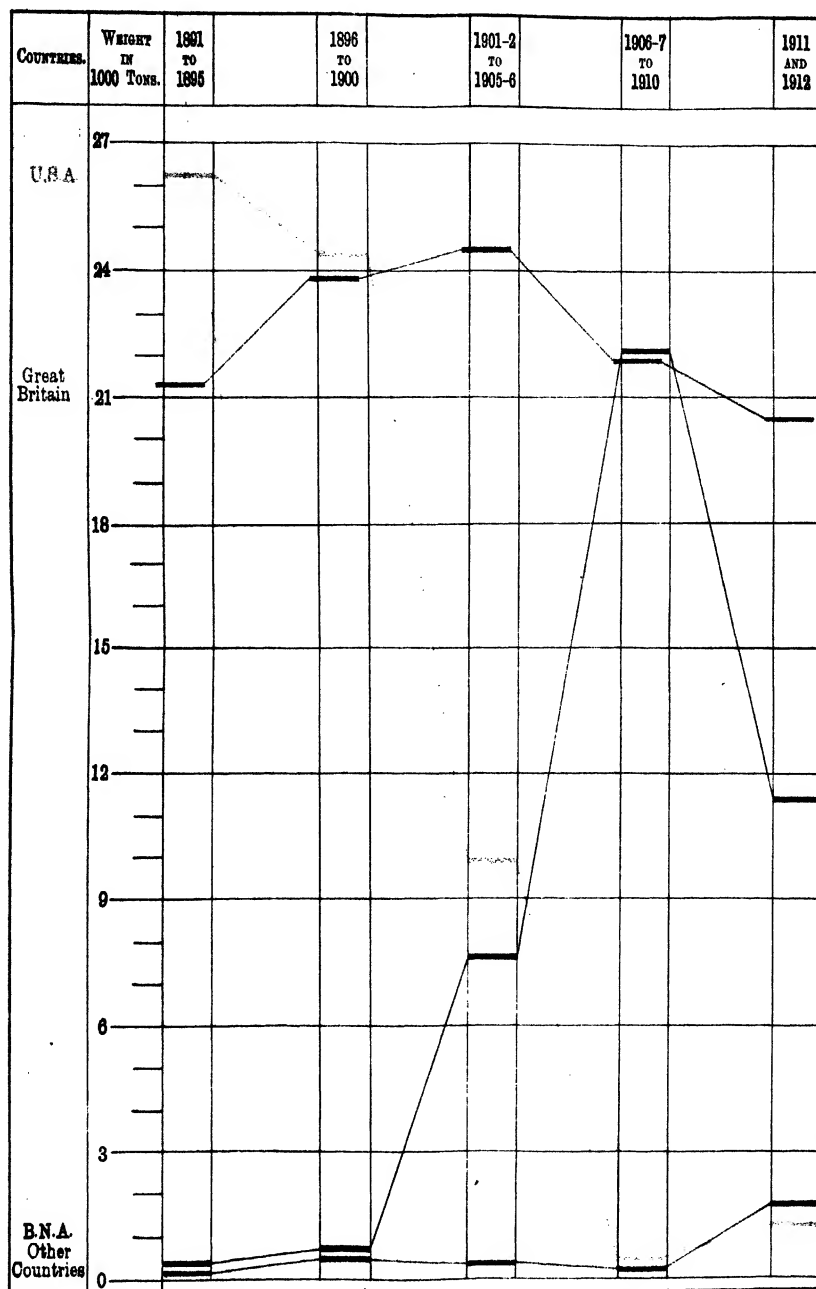
From Report Collector Customs, Trinidad and Tobago, 1912. (Council Paper 126 of 1913)

Exports of Local Cacao to various Countries during each of the Quinquennial Periods 1891-5, 1896-1900, 1901-2 to 1905-6, 1906-7 to 1910, and the years 1911 and 1912.



From Report Collector Customs, Trinidad and Tobago, 1912. (Council Paper 126 of 1913)

Exports of Sugar to various Countries during each of the Quinquennial Periods 1891-5, 1896-1900, 1901-2 to 1905-6, 1906-7 to 1910, and the years 1911 and 1912.



From Report Collector Customs, Trinidad and Tobago, 1912. (Council Paper 126 of 1913)

AGRICULTURAL EDUCATION.

AGRICULTURAL PUPIL SCHEME.

A course of Training in Practical and Theoretical Agriculture.

THE HON'BLE COLONIAL SECRETARY,

I have the honour to submit, for the consideration of His Excellency the Governor, proposals for extending and improving one branch of the system of practical Agricultural Education already conducted by this Department.

The Secretary of State in his despatch of September 23, 1913, which has been communicated to the Agricultural Society, states that, although it is impossible to proceed with the establishment of an Agricultural College in Trinidad, he "would welcome any proposals for widening the sphere of existing educational centres in Trinidad so as to include training in the theory and practice of tropical agriculture for which there are exceptional facilities in the Colony."

RECENT COMMITTEES.

In November, 1911, I proposed at the Board of Agriculture the appointment of a Committee to consider Agricultural Education in the Colony. This was approved of and His Excellency nominated a Committee containing representatives of the Department of Agriculture, the Education Department (Primary and Secondary branches), Board of Agriculture, Agricultural Society, Board of Industrial Training, and Peasant Proprietors. This Committee drew up a preliminary report which was discussed at the West Indian Agricultural Conference of January, 1912, and subsequently presented to the Government.

The report of this Committee was referred to the Agricultural Society and considered by a select committee which reported to the Society on February, 1913, when a lengthy discussion ensued in which Mr. A. V. Stollmeyer, Mr. (now Sir) Norman Lamont and myself took part.

The Government Committee's draft report is contained in the *Bulletin of the Department of Agriculture*, Vol. XI, No. 70, pp. 104-106, and as finally amended, together with the report of the Agricultural Society's Committee and the discussion, in the *Proceedings of the Agricultural Society*, Vol. XIII, pp. 51-84.

It will be evident from the above that the question of Agricultural Education has recently been adequately discussed by representative committees. I now put forward proposals for improving the education in practical and theoretical agriculture already given by the Department under the Agricultural Pupil Scheme to which is designed to train boys to occupy posts as drivers and overseers on estates. This is a thoroughly practical task and the Department receives more applications from would-be pupils than it can deal with at present.

FINANCE.

Finance being an essential consideration, I will deal with it first. I propose that the expenses of the scheme shall be defrayed from the profits made on the estates managed by the Department. For 1913-14 and 1914-15 these are estimated thus :

River Estate.

1913-14 Revenue (revised estimate)	...	\$12,279 80
Expenditure ..	...	7,419 20
Estimated profit ...	...	4,860 60
1914-15 Revenue estimated	...	12,900 00
Expenditure estimated	...	9,304 50
Estimated profit ...	...	2,595 50

I should state that the original estimated revenue for 1913-14 was \$10,208, and that the revenue for 1914-15 has similarly been calculated at a low figure which, it is hoped, will be exceeded.

St. Augustine Estate.

1913-14 Revenue (revised estimate)	...	\$19,290 00
Expenditure estimated	...	15,817 00
Estimated profit ...	...	3,473 00
1914-15 Revenue estimated	...	19,296 00
Expenditure estimated	...	15,754 67
Estimated profit ...	...	3,541 33

I have submitted an outline of my proposals to the Board of Management of the St. Augustine and River estates and the Board has approved :

- (1.) of the principle of using revenue from the estates for defraying the cost of agricultural education.
- (2.) of the allotment of a sum not to exceed \$1,500 from the revenue of River Estate for that purpose in 1914-15.

The Government has approved of the recommendation of the Agricultural Education Committee to found exhibitions for agricultural pupils under this scheme and two of the value of £25 each, have been included in the estimates for 1914-15. These are to be increased to four next year and six the year following.

In future years (and in 1914-15 also if convenient to the Government) the cost of these exhibitions can be met from the sum allotted from the estates for agricultural education.

ENTRANCE EXAMINATION AND AWARDING OF EXHIBITIONS.

I suggest (1.) That every candidate for admission as an Agricultural Pupil shall be required

- (a.) to furnish a certificate of good character from the Head Master of his last school, and one other responsible person.
- (b.) to furnish a medical certificate that he is physically fit.
- (c.) to pass a preliminary qualifying examination in reading, writing and arithmetic.

(2.) That the entrance examination be held once a year, *e.g.* April this year and March in succeeding years, and that those who are competing for exhibitions take in addition to the qualifying subjects an examination in *elementary* agricultural knowledge.

(3.) That for the first year at any rate, the minimum age for a candidate for an exhibition be 16 years as recommended by the Committee.

PERIOD OF TRAINING.

That the course be for three years to be spent as follows :—

First year at River Estate.

Second year at St. Augustine Estate and Government Farm.

Third year on an approved outside estate, in the case of exhibitioners whose exhibition are renewed, and of other students if arrangements can be made.

CURRICULUM.

FIRST YEAR—RIVER ESTATE.

(1.) Practical work in all branches of estate work under the direction of the Manager. This would occupy every morning and about three afternoons each week. In this the boys would work under ordinary estate conditions, keeping the usual hours, being subject to ordinary estate discipline and those not exhibitioners being paid as at present according to the value to the estate of their work.

(2.) Lectures, practical demonstrations, or time for reading, writing up notes, etc., two afternoons each week.

Without going into great detail here, these lectures, etc., might be as follows for 1914-15.

Director of Agriculture (Acting)...	20	{ General life of a plant and its relation to its surroundings and special reference to crops dealt with. Principles underlying pruning, seed selection, grafting, budding and other agricultural practices.
Superintendent Field Experiments...	10	Soils and manures.
Superintendent, River Estate ...	20	{ Cacao cultivation and preparation. Estate practice and management, estate book-keeping, etc.
Manager, River Estate ...	20	
Mycologist ...	10	Fungal diseases, their causes and treatment.
Entomologist ...	10	Insect diseases, their causes and treatment.

In most cases, a lecture would be followed by a practical demonstration in the field and in particular those of the Manager of the estate would be primarily field demonstrations of estate operations.

During the first year, all pupils must do the work of the elementary stage of the Home Reading Course of the Department and take the examination at the end and not be allowed to proceed to the second year's course until they have passed. An exhibitioner failing to pass, unless due

to unavoidable circumstances such as illness, would not have his exhibition renewed, but at the discretion of the Director of Agriculture could continue as an ordinary pupil.

SECOND YEAR.—ST. AUGUSTINE AND GOVERNMENT FARM.

The general division of time between practical estate work and theoretical instruction will be similar to that of the first year; the crops dealt with, however, will be different and there will also be the work of the Farm.

The lectures and practical demonstrations might be as follows:—

Director or Assistant Director ...	15	As in the first year but with special reference to plants and crops dealt with.
Manager St. Augustine and Government Farm ...	80	Estate practice and management. Care of Stock, etc.
Superintendent, Field Experiments...	10	Soils and manures.
Mycologist ...	10	Fungoid diseases, their causes and treatment.
Entomologist ...	10	Insect diseases, their causes and treatment.
Government Veterinary Surgeon	10	General veterinary knowledge.
Farriery Instructor ...	5	Farriery.

During this year pupils must work for the Intermediate Home Reading Course Examination and pass the same before proceeding to approved estates; failure will as in the first year entail loss of exhibition.

THIRD YEAR.—ON AN OUTSIDE ESTATE.

Exhibitioners who have made satisfactory progress in their first and second years will be recommended for a third year which will be spent on an approved estate or estates, the managers of which are willing to accept and house pupils and possibly give them some remuneration for their work.

Pupils will remain on each estate for a time to be agreed upon before hand, and their exhibitions paid subject to satisfactory monthly reports from the manager. It might prove better for some pupils to serve on two estates for six months each than on one for a year; this is a matter which can be settled according to the circumstances in different cases.

Other pupils who have done well and can be recommended will similarly be placed on estates if possible, but having no exhibitions, it will be necessary for estates to give them sufficient to live upon and there may thus be more difficulty in placing non-exhibitioners.

During their period of service on such estate, pupils must work for the advanced stage of the Home Reading Course Examination, and their final certificate will depend partly on their success in the examination.

WORK FOR 1914-15.

In 1914-15 it will only be necessary to start the first year's course. An examination should be held to select the two exhibitioners and as there are already more pupils in the Department than there will be accommodation for at River Estate this year I suggest the competition be restricted to the present pupils of the Department. The arrangements for next year can be considered later.

The number of ordinary pupils now at River Estate is seven, two live on the estate, five at Diego Martin Village. One other student, of a different category, boards with the manager. I propose that additional accommodation be built at the estate to house four more pupils, so that there may be six in residence.

Assuming that, as now, there would be another five or six pupils not in residence, there would be a group of say twelve to take the first year's work, which is as many as can conveniently be dealt with at present.

REMUNERATION FOR LECTURES AND DEMONSTRATIONS.

As the lectures and demonstrations will be additional duties and will entail extra work in their preparation, I propose that officers visiting the estates to give instruction be paid \$5.00 per lecture and accompanying demonstration, out of which they should defray their travelling expenses, and that the Manager be paid at the same rate, as the pupils give him extra work in various other ways also.

COST OF SCHEME

A.—RECURRENT.

	1914-15 \$	1915-16 \$	1916-17 and subsequently \$
Agricultural Exhibitioners ...	(2) 240	(4) 480	(6) 720
Remuneration to Lecturers			
1st year's course ...	450	450	450
2nd year's course ...	...	450	450
Lectures, incidental expenses	50	50	50
Books and Stationery ...	100	50	50
	<u>\$840</u>	<u>\$1,480</u>	<u>\$1,720</u>

B.—EXTRAORDINARY.

1914-15 (1.) Accommodation for four boys at River Estate at cost of about	...	...	...	\$480
(2.) Furniture and fittings for class room			...	100

The expenditure for subsequent years cannot be well estimated for now. But a room to serve as a class room will be required at St. Augustine in 1915-16 and one at River Estate also. The scheme admits of growth, and an expenditure at the rate of \$480 per annum will probably be sufficient for any small necessary buildings for some years.

The chief new features of the scheme now put forward are the arrangements for definite courses of instruction and defrayment of expenses from the revenue of the estates managed by the Department. I trust it will meet with sanction and prove of practical value. Should, however, it fail by any chance it has the advantage that the Colony will not have incurred any heavy capital expenses, nor be committed to the cost of any new organisation.

(Sgd.) W. G. FREEMAN,
Acting Director of Agriculture.

February 26, 1914.

The above scheme was discussed at the meeting of the Agricultural Society on March 13, 1914 and approved of by that body. On March 20 it was similarly adopted by the Board of Agriculture.

Provision has now been made for the expenses of the scheme for the first year in the estimates of River Estate for 1914-15 which have been submitted to His Excellency the Governor for approval.

CACAO PRIZE COMPETITION COMMITTEE.

Report.

The following Report of the Cacao Prize Competition Committee was adopted at the meeting of the Board of Agriculture on March 20, 1914.

Meetings of the Cacao Prize Competition Committee were held in the office of the Director of Agriculture on February 27, and March 20, 1914.

Present on February 27; Mr. W. G. Freeman (Acting Director of Agriculture) Chairman, Messrs. A. B. Carr, W. C. Jardine, Mr. J. de Verteuil (Acting Assistant Director of Agriculture), and Messrs. Brunton and Farfan (Agricultural Inspectors), and on March 20, Messrs. W. G. Freeman, A. B. Carr and W. C. Jardine.

It was decided:—

1. That in the St. Ann's and Diego Martin District

(a.) the Judges be Mr. G. Brown, if he be willing to act, Mr. Brunton, and Mr. Plummer (in place of Mr. Farfan owing to the latter's accident).

(b.) The Board of Agriculture defray Mr. Plummer's expenses.

(c.) The judging take place between March 23 and April 7.

2. That in the Couva and Chaguanas district

(a.) the Judges be Mr. A. B. Carr who agreed to serve, Messrs. Farfan and Brunton.

(b.) The judging take place between April 20 and April 30.

3. That in the Special Competition

(a.) the Judges be Messrs. Augustus and Plummer.

(b.) The Board of Agriculture defray their expenses.

4. That in each competition the Acting Director of Agriculture act as referee if requested by the Judges.

5. That the judging be conducted on the same lines as in last year's competition; the score card was approved.

6. That the prizes for 1914-15 competition be as follows:—

Peasant Proprietors ... \$80, \$60, \$40, \$30, \$20.

Contractors ... 60, 45, 30, 20, 15, \$10, \$5.

Special Competition—Peasant Proprietors \$20. \$10, plus medal in each case.

Contractors \$10. \$5, plus medal in each case.

7. That the prizes in the Vegetable Competition 1914-15 be:—

<i>Brasso and Piparo Districts.</i>			<i>Siparia and Erin Districts.</i>		
Tannias, $\frac{1}{2}$ acre	...	\$10.00	Cassava, $\frac{1}{2}$ acre	...	\$10.00
Cush cush or yam, $\frac{1}{4}$ acre	{	12.00 1st.	Sweet potatoes, $\frac{1}{2}$ acre	{	12.00
		6.00 2nd.			6.00
Bananas, 1 acre	...	10.00	Bananas, 1 acre	...	10.00
Pigeon peas, $\frac{1}{2}$ acre	...	10.00	Pigeon peas, $\frac{1}{2}$ acre	...	10.00
<hr/>			<hr/>		
\$48.00			\$48.00		

RULES.

8. That the rules for the Competition 1914-15 be as follows:—

Cacao Prize Competition.

(1.) Prizes will be awarded for good cultivation of Cacao.

(2.) The prizes will be awarded in two classes.

Class I.—For Peasant Proprietors with not more than 16 acres in cacao cultivation and in one piece.

Class II.—For Contractors.

(3.) No Peasant Proprietor will be allowed to compete in Class I unless he or she has 5 acres in bearing cacao and no contractor will be allowed to compete in Class II who has less than 3 acres in trees three years old at the time of entry.

(4.) No person can compete in more than one class. Previous Prize Winners can only compete under Rule 8.

(5.) Prizes will not be awarded unless there are at least 50 competitors in each of the classes I and II in each district.

(6.) The Prizes offered in *each* district are as follows:—

	1st.	2nd.	3rd.	4th.	5th.	6th.	7th.
Class 1.—Peasant Proprietors	...	\$90	\$60	\$40	\$30	\$20	—
Class 2.—Contractors	...	\$60	\$45	\$30	\$20	\$15	\$10

(7.) The two districts in which the above prizes are offered for competition in 1914-15 are:—

(1.) Siparia and Erin districts.

(2.) Brasso and Piparo districts.

(8.) Four Special Prizes and Medals are also offered for competition amongst prize winners in the previous competitions in the above two

districts and the districts of Arima and Manzanilla and Savana Grande, St. Ann's and Diego Martin, and Brasso, Couva and Chaguanas districts.

(a.) Peasant Proprietors—1st Prize \$20 and Medal.

—2nd Prize \$10 and Medal.

(b.) Contractors

—1st Prize \$10 and Medal.

—2nd Prize \$ 5 and Medal.

These four prizes are for the whole four districts, not four in each district.

(9.) The competition will be for the period April 1, 1914, to March 31 1915.

(10.) In judging, marks will be given under the following heads :—

(1.) Tillage 50 points.

(2.) Sanitation of the cacao field and treatment
of diseases 30 „

(3.) General, including crop records, live stock,
and any special features 20 „

(11.) The method of cultivation and condition of the trees, together with the circumstances of each cultivation, the characteristics of the locality and the implements used, will be considered by the judges. In judging, the condition of young cultivation, if any, will be taken into account.

(12.) The Board, on the report of the judges, may withhold or alter the value of any or all of the prizes if the cultivations entered for competition are not considered of sufficient merit.

(13.) Due notice will be given before the judging commences, and the decision of the Board will in all cases be final.

(14.) Application for rules and entry forms should be made at :—

The District Ward Offices : Post Offices : Agricultural Inspectors residences ; the Warden's Office in the district, or at the office of the Department of Agriculture, Government Buildings Port-of-Spain.

ENTRY TO COMPETITION—FREE.

Entries may be sent post free if addressed to :—

The Agricultural Inspectors.

The Director of Agriculture, Port-of-Spain.

Entries will be received up to July 31, 1914.

The Board's Inspectors will visit all holdings entered for competition and give advice as to the best methods of cultivation free of any charge.

Vegetable Cultivation Prize Competition.

RULES.

(1.) Prizes will be awarded for the best cultivated vegetable garden as in rule 3.

(2.) The prizes will be awarded during 1914-15 in two districts as follows :—

1) Siparia—Erin District

[2) Brasso—Piparo District

(3.) Prizes to be given in each district as follows :—

<i>Siparia—Erin District.</i>			<i>Brasso—Piparo District.</i>		
Best acre Banana...	...	\$10.	Best acre Banana...	...	\$10.
Best $\frac{1}{2}$ acre cassava	...	10.	Best $\frac{1}{2}$ acre Tania	...	10.
Best $\frac{1}{2}$ acre Pigeon Pea	...	10.	Best $\frac{1}{2}$ acre Pigeon Pea	...	10.
Best $\frac{1}{2}$ acre Sweet Potato			Best $\frac{1}{2}$ acre Cush-cush or Yam		
1st prize...	...	\$12.	1st prize	...	\$12.
2nd „	...	6.	2nd „	...	6.

(4.) The competition will be for the period of eleven months from April, 1914 to February 28, 1915.

(5.) Prizes will not be awarded unless there are at least 10 competitors in each class in each district.

(6.) In judging marks will be given under the following heads :—

(a.) Tillage	...	...	...	50 points.
(b.) Planting	...	...	...	20 „
(c.) Sanitation and treatment of disease	...	...	...	20 „
(d.) General	...	...	...	10 „

The method of cultivation and condition of plants, together with the circumstances of each cultivation, the characteristics of the locality and the implements used will be considered by the judges.

(7.) The Board on the report of the Judges, may withhold or alter the value of any or all of the prizes if the cultivations entered for competition are not considered of sufficient merit.

(8.) Due notice will be given before the judging commences, and the decision of the Board will in all cases be final.

(9.) Application for rules and entry forms should be made at :—

The District Ward Offices; Post Offices; Agricultural Inspectors' residences; the Warden's Office in the districts, or at the office of the Department of Agriculture, Government Buildings, Port-of-Spain.

ENTRY TO COMPETITION—FREE.

Entries may be sent post free if addressed to :—

The Agricultural Inspectors.

The Director of Agriculture, Port-of-Spain.

Entries will be received up to July 31, 1914.

The *Board's Inspectors* will visit all holdings entered for competition and give advice as to the best methods of cultivation free of any charge.

(Sgd.) W. G. FREEMAN,
Chairman.

Instruction in Farriery. The Board of Agriculture, on March 20, agreed to a revote of \$120 to the Board of Industrial Training to meet the cost of Courses of Instruction in Farriery in different parts of Trinidad in 1914. Applications have been received from Princes Town and Arima. The report of the Course held at San Fernando in 1913 is given in this Bulletin XIII, January, 1914, pp. 61-63. A pamphlet in farriery is also in course of preparation by Dr. C. L. Boissière, the Instructor in Farriery.

FRUIT.

CASHEW NUTS.

The Department of Agriculture has received an enquiry from a firm in Paris who wish to obtain cashew nuts on the terms indicated in the following extract. The Director of Agriculture will supply the name of the firm to any one who may wish to enter into correspondence on the subject:

"For your guidance we beg to inform you that we generally pay for these kernels about 40 shillings per cwt. nett weight, cases free, goods put up in 2 cwt. cases. This refers to the slightly roasted kernels in order to free them from their hard shell and only the fine thin brown dusk adhering to the kernels."

"We buy annually about 100 tons and would be extremely pleased if you would kindly put us in contact with one or several serious firms in whose shipments we may have entire faith as we are disposed to order this stuff payment against shipping documents."

"Please note that the above-named price is to be understood *c.i.f.* Havre, shipment by steamer not touching a European port before coming to France in order to permit us to enter the goods without special duty obtained from all colonial goods imported into France *via* any European country."

NOYAU.

By H. S. SHREWSBURY, F.I.C., F.C.S.
Acting Government Analyst.

In Trinidad to-day four different flavouring substances two of which are harmless and two poisonous, may be bought as Noyau. Such conditions of sale are most unsatisfactory and have in fact been the direct cause of accidental death from time to time. Thus an innocent customer may purchase as noyau any of the four following substances:

- A. West Indian Essence of Noyau, a spirituous solution of an essential oil of which the kernels of *Prunus occidentalis* and the seeds of *Ipomea dissecta* are stated to be sources.
- B. Essence of Almonds, a spirituous solution of the essential oil of almonds.
- C. Essence of Noyau (so-called), a spirituous solution of nitrobenzene.
- D. Oil of Noyau or pure nitrobenzene.

The dangerous nature of this false synonymy is at once apparent when we consider that *A* and *B* are harmless preparations, that *C* is decidedly poisonous and that *D* is a deadly poison.

The following table exhibits the differences in these preparations:

PREPARATIONS.	ESSENTIAL INGREDIENT.	CHARACTER.	MINIMUM AVERAGE FATAL DOSE.
West Indian Essence of Noyau ...	1-2 per cent. Benzal- dehyde (probably) ...	Non poisonous ...	...
Essence of Almonds.	1-2 per cent. Benzal- dehyde ...	Non poisonous ...	...
False Essence of Noyau... ..	0.5-5.0 per cent. Ni- trobenzene ...	Poisonous ...	1.3 to 6.6 oz.
Oil of Noyau ...	100 per cent. Nitro- benzene ...	Very poisonous ...	20 drops.

A casual glance at this table would perhaps suggest that seven ounces is an absurd quantity of flavouring essence for any cook to employ. This is quite true, but a little further consideration will reveal the danger of even a 0.5 per cent. solution of nitrobenzene. Supposing the flavour to be a favourite one, it is quite possible that its use in the kitchen will cause a family to partake of frequent small doses of nitrobenzene, the cumulative effect of which, though not necessarily fatal, can hardly fail to endanger health to a considerable degree.

But leaving this suggestion, which may perhaps be considered of a speculative nature, the facts to follow indicate with certainty the poisonous character of (*C*) the false essence of Noyau.

On August 31, 1913, a man returned to his home in La Brea. It is supposed that before retiring he drank a considerable quantity of the false essence of noyau, for he was discovered on his death bed in the morning, and the analytical investigation following the *post mortem*, revealed the presence of a fatal dose of nitrobenzene. The man was addicted to drink and probably well aware of the spirituous nature of false noyau, whilst unhappily ignorant of the fatal nature of its essential ingredient.

Passing on to oil of noyau, which is pure nitrobenzene and is also known as oil of mirbane, there is no necessity to point out that a liquid, twenty drops of which is fatal, is not a suitable flavouring essence. But it is well to emphasize the ease with which oil of noyau may be mistaken for and used as essence of noyau. Its appearance is similar and its odour no more powerful than that of the 0.5 per cent. solution. There can be no doubt that deaths have been caused in Port-of-Spain by this inexact and misleading nomenclature.

The following simple test will enable anyone to determine in two minutes whether a sample of noyau is poisonous or very poisonous.

Add a dessert-spoon full of "noyau" to half a tumbler of water. If the liquid remains clear or yields a milky opalescence the "noyau" is the

harmless preparation containing benzaldehyde, whether derived from almonds or some other source or the poisonous false essence of noyau.

If the "noyau" falls to the bottom of the glass and there remains as a visible yellowish layer of liquid insoluble in water it is the very poisonous oil of noyau, nitrobenzene or oil of mirbane.

Nitrobenzene preparations should on no account be used for culinary purposes.

It may be of interest to contrast below the properties of benzaldehyde and nitrobenzene, respectively the harmless and noxious constituents of these flavouring essences :

Character.	Benzaldehyde.	Nitrobenzene.
Formula	C_6H_5CHO	$C_6H_5NO_2$
Molecular Weight	106.05	123.08
Specific Gravity	1.0504 (15° C) (4° C)	1.1866 (14° C) (4° C)
Melting Point	18.5° C	3.0° C
Boiling Point	179.5° C	209.4° C
Appearance	Yellow oily liquid	Yellow oily liquid
Odour	Almonds, characteristically sweet when inhaled	Almonds, pungent when inhaled.
Solubility in alcohol and in either	soluble	soluble.
Solubility in water 100 parts,	0.3	insoluble.

The essential difference between the two compounds is caused by the combination of different groups of elements with the organic radicle C_6H_5 (6 atoms of carbon and 5 of hydrogen) which is common to both as also to many organic compounds, *e.g.*, benzene, phenol, aniline, etc.

The aldehydic grouping CHO (1 atom each of carbon, hydrogen and oxygen), characterises all aldehydes (including benzaldehyde) and is found in certain sugars amongst many other harmless bodies. It does not usually indicate a poisonous substance, although formaldehyde is a notable exception to a general rule.

On the other hand the nitro group NO_2 (1 atom of nitrogen and 2 of oxygen) frequently signifies a dangerous poison.

Nitrobenzene acts physiologically by changing the composition of the blood and depriving it to a great degree of its power of carrying and imparting oxygen to the tissues. It is due to this action, that shortly after taking nitrobenzene there appears a striking blueness or purple appearance of the lips, tongue, skin and nails. This peculiar colour change has been witnessed an hour before any feeling of illness occurred ; in fact the poison has a curious reaction on the organism ; from a quarter to three hours after taking it, a person may feel quite well and then most alarming symptoms will suddenly occur followed by rapid death.

Probably the best preliminary household treatment is a mustard emetic, and the remedy has the special advantage of being easily and quickly procured ; but there should be no delay in summoning a medical attendant who would probably find it necessary to apply the stomach pump.

PLANT DISEASES AND PESTS.

GREEN MUSCARDINE FUNGUS.

In the report to the Board of Agriculture on March 20th, Mr. J. B. Rorer, the Mycologist stated :—

I have started cultures of the green muscardine fungus at the managers of nearly all estates which have cabinets are planning to continue growing the fungus this year. Since the publication of our circulars dealing with this fungus and its use in cane fields, requests for cultures of the fungus have been received from all over the world. Russia, France, Italy, different parts of the United States, various islands in the West Indies, Africa and Samoa.

In the *Scientific American* for February 23, is an article entitled "A triumphant struggle with a beetle, how the coconut trees of Samoa were saved," which tells how the same fungus has been successfully used there against the rhinoceros beetle which threatened the coconut industry. The concluding sentence states. —

"Here in the islands we regard this achievement as a remarkable one ; and as this means of combatting the greatest enemy the coconut tree has ought to be known in all tropical countries, we send it to the *Scientific American*, which circulates everywhere, and whose word is taken as emphatic and dependable."

INSECT PESTS OF 1913.

The following review of the chief insect pests during 1913 was contributed to the March meeting of the Board of Agriculture by Mr. F. W. Ulrich, the Entomologist :—

CACAO.

The abnormally severe drought of 1912 left the cacao trees in a state of low vitality and they were severely attacked by thrips in the northern part of the island and by cacao beetles (*Steirastoma depressum*) in the south, towards the end of 1912 and commencement of 1913. Thrips were very bad in November and December 1912 and up to February 1913, but from March they steadily decreased, and in the months of March, April, May, June, July, August, September, October and November there were not enough to do damage. In December there was a tendency to increase in numbers on pods and on some of the leaves. The increase of the thrips coincided with the ripening of the pods and bore out my observations that thrips breed and increase on nearly matured pods and then migrate to young leaves when the changes of leaf take place. On some plantations cultural methods were applied. Fields affected by thrips in 1912 were forked, limed and drained, and in 1913 these fields remained free from thrips. As a precaution they were also sprayed in December with Bordeaux mixture to which was added 1 per cent. of lysol. It was not necessary to carry out any spraying demonstration for thrips during the year under review.

Cacao beetles occur in both the northern and southern part of the island, but it is principally the south that suffers most from their ravages, notably Moruga, La Lune, Siparia, and Erin. At the end of 1912 the beetles were very bad, they continued to be fairly numerous from January to July when there was a tendency to decrease, but at no time of the year were beetles entirely absent from estates.

Spraying experiments with arsenate of lead were started at Chaguanas, Moruga, La Lune, and Erin, and so far the sprayed trees have enjoyed immunity from beetles. Systematic cutting out of larvæ and trapping of beetles have also yielded good results. In connection with the spraying of the trees with arsenate of lead, it was observed that some species of ants kept away from the sprayed trees. The mixtures used consisted of 4lb. arsenate of lead (paste) to 60 gallons of water, and 4lb. arsenate of lead and 4lb. temper lime to 50 gallons water. The latter formula is preferable for general use. When Bordeaux is used 4lb. of arsenate of lead is added to every 50 gallons of mixture.

In the southern district of La Lune twig girdlers were in evidence in fair numbers in the months of November and December. They do not appear to be as prolific as the cacao beetles and as they exist in the amputated twig their control is fairly easy provided the branches are collected regularly and burnt. The way in which the branches are cut off is quite characteristic and easy to detect.

There were not as many leaf-eating beetles and caterpillars as in the previous year. Beneficial predators and parasites were to be seen in numbers in the fields.

SUGAR CANE.

In 1913 the froghoppers were not as bad as in 1912 and this was in a large measure due to the latter part of 1912 having been comparatively more damp than the corresponding period of 1911. The result was that many eggs that would have aestivated hatched out and the nymphs either did not complete their transformations or were attacked by natural enemies. From field observations carried out during the year it seems that the froghopper egg parasite *Oligosita giraulti* thrives best when the weather is not too wet. In November and December it was quite numerous in some fields of Esperanza estate and up to the present time appears to be thriving especially in grass fields kept damp by ravines.

The parasite was successfully colonized in a field of 22 acres in July. The Syrphid fly (*Salpingogaster nigra*) was not as numerous in the cane fields as in the year before. This fly appears to be very susceptible to dry weather and seems to thrive best in very damp weather. Mexican bugs are still being reared in the laboratory and liberated on sugar estates in the adult stage; so far they have not been established permanently.

The green muscardine fungus has already been reported upon by Mr. Rorer at the August meeting of the Board.

No serious outbreak of small moth-borers (*Diatrea*) striped looper or caterpillars have observed during the year, no doubt due to the efficiency of parasites. The giant moth borer (*Castnia licus*) still continues to occur in some localities, but on estates in which the moths are caught regularly

this pest appears to be diminishing as can be seen from the following figures kindly supplied by the authorities of an estate :—

Total moths caught in	1909	...	...	182,734		
"	"	"	1910	...	...	116,707
"	"	"	1911	...	...	89,768
"	"	"	1912	...	...	52,271
"	"	"	1913	...	...

The cutting out of the caterpillars from the cane stools would also yield good results.

COCONUTS.

No serious outbreak of any coconut pest was reported during the year. Sporadic cases of severe infestation by the coconut scale *Aspidiotus destructor* occurred, but they can be controlled by spraying with lime sulphur wash. It was found that destroying the Balata ant and their nests on the coconut trees helped in a great measure to allow the scale insects to be controlled by their natural enemies.

On the whole the insects of 1913 were not as bad as those of 1912, due no doubt to the weather being more favourable to beneficial orders such as Tachinae and parasitic Hymenoptera.

Bird Vine.—In consequence of a report from a proprietor in Savana Grande that the owners of properties bounding with his were not taking steps to remove bird vine and thus nullified his efforts to keep his property free the area was visited by Mr. J. C. Augustus, one of the Inspectors under the Ordinance, and six notices served for the removal of the pest.

OILS AND OIL SEEDS.

GRU-GRU KERNEL OIL.

The results of an examination of the oil of the kernels of the gru-gru palm (*Acrocomia sclerocarpa*), recently made at the Imperial Institute have been recorded in this *Bulletin* (vol. xii, 1913, p. 137).

Another sample from Trinidad has since been analysed by Mr. A. W. Knapp, B.Sc., F.I.C., who publishes his results in the *Journal of the Society of Chemical Industry*, (Vol. xxxiii p. 9.) The analyses are compared below, together with the corresponding data for palm kernel and coconut oils.

Mr. Knapp visited Trinidad in the winter of 1912 and took back to England personally collected samples of gru-gru fruits, which are the source of these figures.

FRUIT.

	Length	...	...	1½ inch.
	Breadth	...	...	1¼ "
	Weight	...	...	30 grammes.
Per cent.	Pericarp	...	...	59.73
	Shell...	...	...	31.30
	Kernel	...	...	8.97

"Dry ether extracts 2.44 per cent. from the pulp of the pericarp," i.e., 2.44 represents the maximum percentage of oil in the pericarp of this sample.

KERNEL.

<i>Figures by A. W. Knapp.</i>				<i>Figures by Imperial Institute</i>	
Fat (Petroleum ether extract)	49.13			57.	(solvent not quoted).
Water	...	...	8.14	6.1	
Albuminoids	...	...	13.70	—	
Fibre and unestimated	...	...	29.03	—	
			100.00		

A tree examined by Knapp bore 9 large bunches, each containing about 400 fruits, a total of 3,600.

This represents an absolute weight of 4.76 kilogrammes of oil per tree equal to 10.5 lb. or about 1.2 gallons, some of which would be lost on account of imperfect expression.

Knapp obtained the oil by pressing the kernels when hot; the Imperial Institute's method is not recorded.

DATUM.	Gru-Grü Oil observed by A. W. Knapp.	Gru-Grü Oil observed by Imperial Institute.	Palm Kernel Oil.	Coconut Oil Results of 24 Observers.
Colour	... Very pale yellow.			
Odour	... Like coconut oil.			
Taste	... "			
Specific Gravity (99° C. water 15·5°.)	0·861	0·867	0·873	0·903
Melting Point	... 26·0° C	...	23°-30° C	23°-27° C
Iodine Value	... 19·4	16·2	10·3-17·5	8-10
Refraction at 40° C. (Zeiss butyro- re- fractometer	... 37·0	...	36·5	33·5 35·5
Saponification value	243·5	253·7	242·4-254·8	250-268
Reichert Meissl	... 7·2	5·7	5·0-6·8	6·7-8·4
Polensko	... 13·9	12·6	...	15·5-20·5
Shrewsbury and Knapp	... 163·0	...	...	163·
Free fatty acids (as Oleic)	... 0·62	0·65*		

Comparison with other figures indicates that gru-gru oil is the same as the Mocaya oil of Paraguay, and the oil from the maccasuba palm of Surinam. It is also very similar to coconut and palm kernel oils and from its indicated percentage of olein should have about the same value as palm kernel oil. Knapp agrees in this valuation with the Imperial Institute report which priced palm kernels and gru-gru kernels at £23 5 0 to £24 per ton *ex* quay Liverpool (Sept. 1913).

The soap yielded by the oil is almost white and has excellent lathering properties and its "stearine" would make a good edible fat.

The shells when cracked are heavy enough to be separated from the kernels by immersion in brine.

As the analytical data for oils, fats and waxes are of a very technical nature, some explanation of their significance is appended.

The iodine value expresses the sample's power of combining with iodine and depends largely on the percentage of constituents which give

* Calculated from acid value given by Imperial Institute.

certain oils their drying properties, *e.g.*, the figures for linseed oil (178-201) are much higher than those of any other oil with the exception of perhaps one or two.

The refraction is a very useful physical datum depending on an oil's power of bending a ray of light. It is taken at a definite temperature and usually in a Zeiss Butyro Refractometer. The figures serves mostly for purposes of identification.

The saponification indicates directly the amount of alkali required to convert a constant weight of oil into soap.

The Reichert Meissl measures the amount of soluble volatile fatty acids (*e.g.* acetic, butyric.) The acids occur in the oils combined with glycerine to form glycerides, substances of an oily or fatty nature. Butter has a peculiarly high Reichert Meissl (30.0) and next in order amongst oils and fats come coconut oil, palm kernel oil, gru-gru oil, etc., which also have characteristically high figures.

The Polenske measures insoluble volatile acids and is specially high in the case of coconut, palm kernel, gru-gru oils, &c.

The Shrewsbury and Knapp figure is specific for the coconut class of oils. It measures glycerides like laurin and myristin, of which coconut oil, palm kernel oil, &c., are largely and peculiarly composed. Thus the figures for coconut oil, gru-gru oil, butter fat and lard are respectively 163, 163, 23 and 15.7.

The acidity as oleic acid indicates the rancidity of the sample.

H. S. S.

BOTANICAL.

NURSERY STOCK LIST.

Botanic Gardens, Trinidad.

THE following is the list of plants usually available from the nursery at St. Clair Experiment Station. The regulations for the sale of plants are given on page iv.:

SCIENTIFIC NAME.	COMMON NAME.	PRICE PER PLANT.
	Fruits.	\$ c.
<i>Achras sapota</i> ...	...Sapodilla ...	5
<i>Anona muricata</i> ...	...Sour sop... ..	5
„ <i>reticulata</i> ...	...Custard apple ...	5
„ <i>squamosa</i> ...	...Sugar apple ...	5
<i>Anacardium occidentale</i>	...Cashew	5
<i>Artocarpus incisa</i> ...	...Breadfruit ...	60
„ .. <i>var.</i>	...Breadnut	5
„ <i>Lakoocha</i>	...Lakoocha	5
„ <i>intergrifolw</i>	...Jackfruit	5
<i>Blighia sapida</i> ...	...Ackee	5
<i>Carica Papaya</i> ...	...Papaw	5
<i>Chrysophyllum Cainito</i>	...Star apple ...	5
<i>Citrus medica</i> var. <i>acida</i>	...Lime	8
„ <i>medica</i> var. <i>limonum</i>	...Lemon	3
„ <i>nobilis</i> var. ...	...Tangerine	5
<i>Diospyrus mabola</i> ...	...Mabola	5
<i>Durio zabethinus</i> ...	.. Durian	5
<i>Eugenia Jambos</i> ..	...Rose apple ...	5
<i>Eugenia malaccensis</i>	.. Malacca apple ...	5
<i>Flacourtia Ramontchi</i>	...Governor plum ...	5
<i>Garcinia Mangostana</i>	...Mangosteen ...	1 00
„ <i>Xanthochymus</i>	... ..	5
<i>Grias cauliflora</i> ...	...Anchovy pear ...	5
<i>Melicocca bijuga</i> ...	...Genip	5
<i>Mimusops globosa</i> ...	...Balata	5
<i>Omphalea triandra</i>...	...Hunterman's nut ...	5
<i>Passiflora lauriflora</i>	...Belle apple ...	5
„ <i>macrocarpa</i>	...Granadilla	5
<i>Persea gratissima</i> ...	...Avocado pear ...	5
<i>Psidium Guajava</i> ...	...Large red guava ...	5
<i>Punica granatum</i> ...	...Poincgranate ...	5
<i>Spondias dulcis</i> ..	...Golden apple ...	5
<i>Tamarindus indica</i>...	.. Tamarind	5
<i>Terminalia Catappa</i>	...Almond	5
<i>Bertholletia excelsa</i>	...Brazil nut	5
<i>Caryocar nuciferum</i>	...Butter nut	5
<i>Eugenia Jambolana</i>	...Java plum	5
„ <i>aquea</i> ...	...Pear shape white apple ..	5
<i>Eriobotrya japonica</i>	...Loquat	5
<i>Macadamia tenuifolia</i>	...Queensland nut ...	5

SCIENTIFIC NAME.	COMMON NAME.	PRICE PER PLANT.
Fruits.—Continued.		\$ c.
<i>Mammea americana</i>	...Manmy apple ...	.. 5
<i>Malpighia glabra</i> ...	...Barbados cherry ...	... 5
<i>Monstera deliciosa</i> ...	... ..	... 5
<i>Nephelium Lit-chi</i>	...Litchie ...	... 5
<i>Storculia carthaginensis</i>	...Coolie pistache ...	... 5
<i>Spondias graveolens</i>	...Hog plum ...	... 5
<i>Sideroxylon</i> sp. ...	...Yellow star apple ..	... 5
<i>Rheedia latifolia</i>...	...Hatstand Tree ...	... 5
<i>Triphasia trifoliata</i>	...Sweet lime ...	... 5
<i>Vangueria edulis</i> ...	...Tamarinde des Indes	... 5
<i>Citrus aurantium</i> var.	...Navel ...	... 24
" " ...	...King ...	}
" " ...	...Ruby ...	
" " ...	...Jaffa ...	
" " ...	...Pine apple ...	
" " ...	...Homosassa ...	
" " ...	...Majorca ...	
" " ...	...Sandford's Mediterranean	
" " ...	...Laub's Summers ...	
" " ...	...St. Michael ...	
" " ...	...St. Michael's Blood ...	
" " ...	...Parson Brown ...	
" " ...	...Tardiff Hart's Late ...	
<i>Citrus medica</i> var. <i>acida</i>	...Spineless lime }
" " "	...Seedless lime }
" " "	...Shaddock }
Beverage Plants.		
<i>Coffea arabica</i> ...	...Arabian coffee ...	... 3
" " var. ...	...Golden drop coffee ...	... 3
" <i>robusta</i> ...	...Robusta coffee ...	... 3
<i>Theobroma Cacao</i> var.	...Forastero ..	... 3
<i>Olea acuminata</i> ...	...Kola ...	... 3
<i>Coffea stenophylla</i> ...	...Narrow leaf coffee ..	... 3
" <i>Liberica</i> ...	...Liberian ...	... 3
" <i>Abbeokuta</i> ...	...Abbeokuta ...	... 3
" <i>Maragogipe</i>...	...Maragogipe ...	... 3
<i>Camellia Thea</i> ...	...Tea ...	... 3
<i>Theobroma cacao</i> var.	...Criollo ...	... 3
" " ...	...Calabacello ...	... 3
" " ...	...Alligator ...	... 3
Spices.		
<i>Piper Betle</i> ...	...Betel pepper ...	... 3
" <i>nigrum</i> ...	...Black pepper ...	... 3
<i>Pimenta officinalis</i> ...	...Jamaica pimento ..	... 3
<i>Vanilla planifolia</i> ...	...Vanilla ...	... 3

SCIENTIFIC NAME.	COMMON NAME.	PRICE PER PLANT.
		\$ c.
Spices.—Continued.		
<i>Cinnamomum Camphora</i>	...Camphor ...	12
„ <i>zeylanicum</i>	...Cinnamon ...	10
<i>Dipteryx odorata</i> ...	...Tonka bean ...	8
<i>Eugenia caryophyllata</i>	...Clove ...	8
<i>Myristica fragrans</i>...	...Nutmeg ...	5
<i>Pimenta acris</i> ...	...Bay berry ...	5
Rubbers.		
<i>Castilleja elastica</i> ...	...Central American rubber ...	3
<i>Cryptostegia grandiflora</i>	...Rubber Vine ...	5
<i>Funtumia elastica</i> ...	...West African rubber ...	3
<i>Hevea brasiliensis</i> ...	...Para rubber ...	5
<i>Landolphia sp.</i> ...	...African rubber vine... ..	12
<i>Manihot Glaziovii</i> ...	...Ceara Rubber ...	5
<i>Mimusops globosa</i> ...	...Balata ...	5
Drugs.		
<i>Carica Papaya</i> ...	...Papaw ...	5
<i>Erythroxylon Coca</i>...	...Cocaine ...	5
<i>Aegle Marmelos</i> ...	...Bhel nut ...	12
<i>Acacia Catechu</i> ...	...Catechu... ..	5
<i>Arca Catechu</i> ...	...Betel nut ...	12
<i>Quassia amara</i> ...	...Bitter wood ...	5
<i>Sarcocephalus esculentus</i>	... ..	5
<i>Strychnos nux vomica</i>	... Nux vomica ...	5
Fibre Plants.		
<i>Sansevieria sp.</i> ...	...Sansevieria fibre ...	5
<i>Agave rigida</i> var. <i>elongata</i>	...Sisal hemp ...	5
<i>Caryota urens</i> ...	...Kittul Palm ...	5
<i>Hibiscus elatus</i> ...	...Cobbast ...	5
<i>Musa textilis</i> ...	...Manila hemp ...	10
Timber and Decorative Trees.		
<i>Andenanthera pavonina</i>	...Red Sandal wood ...	5
<i>Acacia Farnesiana</i> ...	...Fragrant acacia ...	5
<i>Albizia Lebbek</i> ...	...Yoke ...	5
<i>Bauhinia megalandra</i>	... ..	5
<i>Berrya Ammonilla</i> ...	... ..	5
<i>Brounea coccinea</i> ...	... ..	5
„ <i>grandiflora</i>	... ..	5
„ <i>grandiceps</i>	... ..	5
<i>Barringtonia speciosa</i>	... ..	5
<i>Caesalpinia coriaria</i>	...Divi-Divi ...	5
<i>Cynometra trinitensis</i>	... ..	5

SCIENTIFIC NAME.	COMMON NAME.	PRICE PER PLANT.
Timber and Decorative Trees.—Continued.		
		\$ c.
<i>Cassia fistula</i> ...	...Indian laburnum ...	5
„ <i>grandis</i> ...	...Horse cassia ...	5
„ <i>javanica</i> ...	...Apple Blossom cassia ...	5
„ <i>multijuga</i> ...	...Yellow cassia ...	5
„ <i>moschata</i> ...	... ..	5
<i>Copaifera officinale</i> ...	...Balsam of Copaiba ...	5
<i>Detarium senegalense</i> ...	... ..	5
<i>Eucalyptus tereticornis</i> ...	...Eucalyptus ...	5
<i>Guaiacum sanctum</i>...	... ..	5
<i>G. officinalis</i> ...	...Lignum Vitæ ...	5
<i>Jacaranda coerulea</i>...	...Fern tree ...	5
<i>Lonchocarpus</i> sp. ...	... ..	5
<i>Mimusops Elengi</i> ...	...Ghee tree ...	5
<i>Parmentiera cereifera</i> ...	...Candle tree ...	5
<i>Picrodendron juglans</i> ...	...Jamaica Walnut ...	5
<i>Poinciana regia</i> ...	...Flamboyante ...	5
<i>Peltophorum Linnæi</i> ...	...Braziletto ...	5
„ <i>ferrugineum</i> ...	... ..	5
<i>Paclura aquatica</i> ...	...Wild chestnut ...	5
<i>Peltogyne porphyrocardia</i> ...	...Purple heart ...	5
<i>Saraca indica</i> ...	... ..	5
<i>Swartzia pinnata</i> ...	... ..	5
„ <i>grandiflora</i> ...	... ..	5
<i>Swietenia mahogani</i> ...	...West Indian Mahogany ...	5
„ <i>macrophylla</i> ...	...British Honduras Mahogany ...	5
<i>Tabebuia rosea</i> ...	... ..	5
„ <i>serratifolia</i> ...	...Poui ...	5
<i>Terminalia arjuna</i> ...	...Beef tree ...	5
„ <i>Catappa</i> ...	...Almond ...	5
<i>Ardisia Pickeringia</i> ...	... ..	5
<i>Cedrela odorata</i> ...	...Cedar ...	5
<i>Couroupita guianensis</i> ...	...Cannon ball tree ...	5
<i>Carapa guianensis</i> ...	.. Carapa ...	5
<i>Cordia gerascanthus</i> ...	...Black Cyp ...	5
„ <i>sulcata</i> ...	...White Cyp ...	5
<i>Cariniana exigua</i> ...	...Monkey pot ...	5
<i>Centrolobium paraense</i> ...	... ..	5
<i>Dillenia speciosa</i> ...	... ..	10
<i>Eriodendron anfractuosum</i> ...	...Silk cotton ...	5
<i>Eperua falcata</i> ...	...Wallaba ...	10
„ <i>Jenmani</i> ...	... ..	10
<i>Entolobium cyclcarpum</i> ...	...Devil's ear ...	5
<i>Guaiacum officinale</i> ..	...Lignum vitæ ...	5
<i>Haematoxylon campeachianum</i>...	...Logwood ...	5
<i>Hymenoclea Courbaril</i> ...	...Locust ...	5
<i>Lucuma Hartii</i> ...	...Contrevent ...	5
„ <i>multiflora</i>...	...Pain d'epiece ...	5

SCIENTIFIC NAME.	COMMON NAME.	PRICE PER PLANT.
Timber and Decorative Trees.—Continued.		\$ c.
<i>Murraya exotica</i> ...	.. Murraya ...	5
<i>Pithecolobium Berterianum</i> ...	...Naked Indian ...	5
„ <i>Saman</i> ...	...Saman ...	5
<i>Piscidia Erythrina</i> ...	...Dog wood ...	5
<i>Platymiscium platystachyum</i> ...	...Roble ...	5
<i>Prioria copaifera</i> ...	... ..	5
<i>Roupala montana</i> ...	...Beef wood ...	5
<i>Sapindus inaequalis</i> ...	...Soap berry ...	5
<i>Sideroxylon mastichodendron</i> ...	...Acoma ...	5
<i>Toluifera Balsamum</i> ...	...Balsam of Tolu ...	5
<i>Amyris trinitatis</i> ...	...Incense wood ...	5
<i>Bauhinia megalandra</i> ...	... ..	5
„ <i>purpurea</i> ...	... ..	5
„ <i>Petersiana</i> ...	... ..	5
<i>Brunfelsia americana</i> ...	... ..	5
<i>Erythrina corallodendron</i> ...	...Coral bean ...	5
„ <i>velutina</i> ...	...Bocare ...	5
„ <i>umbrosa</i> ...	...Anauca ...	5
<i>Gliricida maculata</i> ...	...Nicaraguan cacao shade ...	5
<i>Garcinia</i> sp. ...	... ..	5
<i>Hura crepitans</i> ...	...Sandbox ...	5
<i>Lagerstroemia indica</i> ...	... ..	10
„ <i>alba</i> ...	... ..	10
<i>Melia sempervirens</i>...	...Wild lilac ...	5
<i>Poinciana pulcherrima</i> ...	...Barbados pride ...	5
<i>Bauhinia glandulosa</i> ...	... ..	5
<i>Bixa Orellana</i> ...	...Anatto ...	5
<i>Cookia punctata</i> ...	... ..	5
<i>Colvillea racemosa</i> ...	... ..	10
<i>Crescentia cujete</i> ...	...Calabash ...	5
<i>Ficus religiosa</i> ...	...Sacred fig ...	25
„ <i>benjamina</i> var. <i>comosa</i> ...	...Ceylon Willow ...	25
<i>Kopsia fruticosa</i> ...	... ..	5
<i>Lagerstroemia Flos-reginae</i> ...	...Queen of flowers ...	10
<i>Noronhia emarginata</i> ...	... ..	5
<i>Spathelia simplex</i> ...	...Jamaica Mountain Pride ...	5

Decorative Foliage Plants.

<i>Acalypha tricolor</i> ...	...Acalypha ...	5
<i>Aralia Veitchii</i> ..	... ..	5
<i>Casuarina stricta</i> ...	...Whistling Pine ...	5
<i>Codiaeum variegatum</i> (assorted)	Croton ...	From 5
<i>Eranthemum</i> sp. ...	... ..	5
<i>Thunbergia erecta</i> ...	...Thunbergia ...	5
<i>Bambusa</i> sp. ...	...Bamboo ...	5
<i>Asparagus plumosus</i> ...	...Asparagus Fern ...	10
<i>Asparagus Sprengeri</i> ...	... ..	10

SCIENTIFIC NAME.	COMMON NAME.	PRICE PER PLANT.
Decorative Foliage Plants.—Continued.		\$ c.
<i>Dracaena Godseffiana</i> ...	...	5
<i>Dracaena</i> sp. ...	...Rayo. <i>Dracaena</i> ...	5
<i>Thuja orientalis</i> ...	...Arbor Vitæ ...	10
<i>Alpinia nobilis</i> ...	...	10
<i>Bryophyllum crenatum</i> ...	...Leaf of Life ...	5
<i>Calathea</i> sp. ...	...	10
<i>Caladium</i> sp. ...	...	From 10
<i>Dieffenbachia picta</i> ...	...	10
<i>Euphorbia</i> sp. ...	...	5
<i>Graptophyllum vermicolor</i> ...	...	5
" <i>bicolor</i> ...	...	5
<i>Panax</i> sp. ...	...	...
<i>Ravensala madagascariensis</i> ...	...Traveller's Tree ...	50
<i>Sanchezia nobilis</i> ...	...	10

Decorative Flowering Plants.

<i>Ardisia coccinea</i> ...	...	10
<i>Acalypha hispida</i> ...	...	5
<i>Duranta Plumieri</i> ...	...	5
<i>Eranthemum reticulatum</i> ...	...	5
<i>Eranthemum</i> sp. ...	...	5
<i>Hibiscus mutabilis</i>...	...Changeable Rose ...	5
<i>Hibiscus rosa sinensis</i> varieties..	...	5
<i>Ixora coccinea</i> ...	...Red <i>Ixora</i> ...	5
" <i>rosea</i> ...	...Scarlet <i>Ixora</i> ...	48
" <i>lutea</i> ...	...Yellow <i>Ixora</i> ...	48
<i>Thunbergia erecta</i> ...	...	5
<i>Jatropha multifida</i>...	...	5
<i>Lawsonia alba</i> ...	...West Indian Mignonette ...	5
<i>Petrea alba</i> ...	...White <i>Petrea</i> ...	25
" <i>volubilis</i> ...	...Blue <i>Petrea</i> , Lilac ...	10
<i>Plumeria alba</i> ...	...White Frangipani ...	10
" <i>rosea</i> ...	...Red Frangipani ...	10
<i>Randia longiflora</i> ...	...	5
<i>Thunbergia alba</i> ...	...White <i>Thunbergia</i> ...	5
<i>Baleria cristata</i> ...	...	5
<i>Euphorbia pulcherrima</i> ...	...Poinsettia ...	10
<i>Gardenia</i> sp. ...	...	12
<i>Holmskioldia sanguinea</i> ...	...Chinese Hat ...	10
<i>Justicia</i> sp. ...	...	...
<i>Jasminum gracillimum</i> ...	...Jasmine ...	20
<i>Nyctanthes Arbor-tristis</i> ...	...Lady of the Night ...	12
<i>Russelia juncea</i> ...	...Antigua Heath ...	12
<i>Rondeletia speciosa</i>...	...Rondeletia ...	60
<i>Salvia</i> sp. ...	...Scarlet Sage ...	5
<i>Stiffia chrysantha</i>...	...	50
<i>Tabernaemontana capensis</i> ...	...	24

SCIENTIFIC NAME.	COMMON NAME.	PRICE PER PLANT.
Decorative Climbers.		
<i>Antigonon leptopus</i>...	...Corallita...	\$ 5
<i>Allamanda Schottii</i>...	...Allamanda...	5
<i>Anemopaegma carrense</i>	... ..	20
<i>Bougainvillea glabra</i>	...Purple Bougainvillea	25
" <i>spectabilis</i>	...Brick red Bougainvillea	1 00
<i>Bougainvillea sp.</i> ...	...Crimson Bougainvillea	1 00
<i>Cryptostegia grandiflora</i>	... ..	10
<i>Clitoria ternatea</i> ...	...Blue Pea	5
<i>Stephanotis floribunda</i>	...Stephanotis	10
<i>Ipomoea sp.</i> ...	... ..	5
<i>Aristolochia grandiflora</i>	...Swan Flower	5
" <i>elegans</i>	... " "	5
<i>Asystasia coromandeliana</i>	... ..	5
<i>Beaumontia grandiflora</i>	... ..	50
<i>Clitoria alba</i> ...	...White Pea	5
<i>Ficus repens</i> ...	..." Ivy "	5
<i>Loniceræ japonica</i> ...	...Honey Suckle	10
<i>Odontadenia speciosa</i>	...Savannah Flower	30
<i>Porana paniculata</i>...	...Corallila ..	5
<i>Quisqualis indica</i> ...	... ..	10

Palms, etc.

<i>Ancistrolobus carneus</i>	... ..	...
<i>Chrysalidocarpus lutescens</i>	... ..	...
<i>Hyophorbe Verschaffeltii</i>	... ..	...
<i>Licuala grandis</i> ...	... ..	...
<i>Ocodoxa regia</i> ...	...Royal Palm	...
<i>O. oleracea</i> ...	...Cabbage Palm.	Palmiste
<i>Sabal glaucescens</i> ...	... ..	...
<i>Thrinax argentea</i> ...	...Thatch Palm	...
<i>Caryota sabelifera</i> ...	... ..	...
<i>Caryota urens</i> ...	...Wine Palm, Fishtail Palm	...
<i>Latania glaucophylla</i>	... ..	...
<i>Livistona altissima</i>...	... ..	...
<i>Livistona chinensis</i>...	... ..	...
<i>Phoenix dactylifera</i>	...Date Palm	...
<i>Sabal acualis</i> ...	... ..	...
<i>Thrinax barbadensis</i>	... ..	...
<i>Cocos sp.</i> ...	... ..	...
<i>Guilielma speciosa</i>...	...Peach Palm	...
<i>Licuala peltata</i> ...	... ..	...
<i>Phoenix rupicola</i> ...	... ..	...
<i>Seaforthia elegans</i> ...	... ..	...
<i>Pritchardia pacifica</i>	... ..	...
<i>Raphis flabelliformis</i>	...Partridge cane Palm	...
<i>Arcoa catechu</i> ...	...Betel Nut Palm	...
<i>Attalea spectabilis</i> ...	... ..	...

From 12 cents upwards according to size.

SCIENTIFIC NAME.	COMMON NAME.	PRICE PER PLANT.
Palms, &c.—Continued.		
<i>Arenga saccharifera</i>	...Sugar Palm	...
<i>Bactris minor</i>	...	...
" <i>sp.</i>	...	...
<i>Desmoncus minor</i>	...	...
<i>Livistona Jenkinsiana</i>	...	...
<i>Sabal acaulis</i>	...	...
<i>Phytelphas macrocarpa</i>	...Vegetable Ivory	...
<i>Verschaffeltia splendida</i>	...	...
<i>Carludovica palmata</i>	...Panama Hat plant	...
<i>Attalea cohune</i>	...Cohune Palm	...
<i>Bentinckia nicobarica</i>	...	...
<i>Corypha elata</i>	...	...
<i>Kentia Forsteriana</i>	...	...
" <i>Macathurii</i>	...	...
<i>Martinezia caryotaefolia</i>	...	...
<i>Sabal Blacburnianum</i>	...	...
" <i>umbraculifera</i>	...	...
<i>Acrocomia sclerocarpa</i>	...Gru gru palm	...
<i>Cocos sp.</i>	...	...
<i>Licuala spinosa</i>	...	...
<i>Thrinax radiata</i>	...	...
<i>Thrinax Morrisii</i>	...	...
<i>Pandanus spp.</i>	...Screw Pines	...
<i>Cycas revoluta</i>	...False Sago Palm	...
<i>Cycas circinalis</i>	...	...

From 12 cts. upwards
according to size.

25

From 12 cents upwards according
to size.

25

25

25

RECENT ADDITION TO THE BOTANIC GARDENS.

The Carob or True Locust.

Seeds of the Carob (*Ceratonia Siliqua*) also known as the Locust bean, St. John's Bread, were received from the Director of Agriculture, Cyprus, in March, 1911, and about 60 healthy plants have been raised.

The following account of the tree is taken from the *Standard Cyclopaedia of Modern Agriculture*. It will be noted that the tree is likely to thrive in the tropics in comparatively dry localities with a calcareous soil. It is possible therefore that it would be found suited to the Leeward district of Tobago, where it may well prove of value as a source of food for stock for which purpose the beans are largely imported into the United Kingdom from the Mediterranean region.

" There are various trees known popularly as Locust trees, chiefly the Locust tree of Palestine (*Ceratonia Siliqua*, the Carob tree), the Locust of the West Indies (*Hymenaea Courbaril*), and the false Acacia tree, (*Robinia Pseudacacia*); all these are members of the *Leguminosae*. The most important is the carob, the algaroba of Spain. It is a slow-growing, low and much branched tree, indigenous to the eastern Mediterranean region and to Syria. It has been diffused in modern times to all warm temperate,

and to some extent also to tropical countries, provided both soil and atmosphere are fairly dry, and the subsoil calcareous. It is accordingly of special value to countries subject to droughts. It is said that the finest qualities are to-day produced in Cyprus. But its regular cultivation seems only to have been undertaken in historic times, and by the Arabs originally. To obtain the finer qualities, grafting is essential. The pods, full of sweet pulp, are a common article of food throughout the area of systematic cultivation, and horses, cattle, pigs, and to some extent men also, are fed on it. Large quantities are used in England in the preparation of certain cattle foods, and it is believed the meat of sheep and pigs is improved by a diet of locusts. Horses are said to take readily 6 lb. of the crushed pods, raw or cooked, and with or without an admixture of chaff. Sugar pectose gum, takes the place very largely of starch in other food substances, and accordingly, locusts are heat givers of less nutrient value than starch foods. The imports into Great Britain seem to be steadily increasing. In 1903 they came to 632,756 cwt., valued at £157,068, and had increased in 1907 to 972,006 cwt., valued at £232,113.

"About one-half comes from Cyprus, a little less than one-third from Portugal, and the balance from Algeria and Turkey in Asia."

BIRDS.

BIRDS AND THEIR VALUE TO THE AGRICULTURIST With Some Notes Concerning Insects.

By P. L. GUPPY.

CONTENTS.

PART I.

- 1—Introductory.
- 2—Thinning out birds under certain conditions.
- 3—Birds frequenting cacao-groves—*Useful*—Tables I and II.
- 4— " " " *Harmful*—Table III.
- 5—Birds affecting the Sugar-Planter—*Useful*—Table IV.
- 6—Summary and recommendations.

PART II.

- 1—General notes on bird-life.
- 2—Birds injurious to rice-fields.
- 3— " " to fruit-growing industries.
- 4— " " in other ways.

PART III.

- 1—Parasitic insects.
- 2—Parasitic fungi.
- 3—Cultural methods.
- 4—Conclusion.

(PART I.)—INTRODUCTORY.

In a very interesting and practical work entitled **A Manual of Injurious Insects*, the subject of the value of birds to the agriculturist is given considerable attention.

I have thought it a good thing to start my paper by quoting from this work ; some of the paragraphs selected appear to fit in so well with local experience, and although they refer to the bird-life of a temperate region there is no doubt that similar information is required in Trinidad.

*By Walter E. Collinge, M.Sc., F.L.S. &c.—published by The Midland Educational Co., Ltd., Birmingham 1912.

Most of the paragraphs quoted occur under the head of "Thinning out birds under certain conditions."

In the course of correspondence with Mr. S. M. Klages I have gathered much useful information, and his valuable notes have been used to a large extent in compiling this paper. Mr. Klages has spent some lengthy periods in this Colony; he is a scientific and accurate observer, who has had exceptional advantages for studying birds and their habits. I should say that he is one of our best authorities on birds that affect the agriculturist. Mr. A. B. Carr has long been known as one of our best informed ornithologists and his useful contributions to our knowledge of bird life have been of help to me.

It is hoped that the information obtained from these sources, together with records of my own made from time to time, which appear in this paper will be found useful, and help to draw attention to the necessity for thoroughly investigating the whole question of the value of birds to the Agriculturist.*

Some remarks on the subject of "Insect Enemies of Insects" are given at the end of this paper (Part III), to show that it is mainly to beneficial insects rather than bird-life, that we must count on the balance nature being maintained.

THINNING OUT BIRDS UNDER CERTAIN CONDITIONS.

Some of the following passages appear in *A Manual of Injurious Insects* on this important point:—

"(1.) At the outset let me state a fact that is far too often overlooked by many who advocate the indiscriminate protection of wild-birds, that there are certain species which are distinctly beneficial to the farmer, fruit grower, and gardener, *if not allowed to become too numerous* [italics mine], but as soon as their numbers exceed a certain limit they become equally injurious. . . ."

(2.) "As yet neither the farmer nor the bird-lover have paid sufficient attention to sifting the facts and separating the same from prejudice and hearsay. We want much more detailed information as to the food of different birds, and the collection of this information must extend over the whole of twelve months of the year, and for successive years, and in different localities."

(3.) "No one will, I think, deny that birds as a class are much more beneficial than they are injurious to the agriculturist. This is openly granted by farmers and others, but it is with reference to, comparatively speaking, a few species only, that so much diversity of opinion exists."

(4.) "The starling, blackbird, fieldfare, thrush and rook are distinctly the farmers' friends but when allowed to increase unduly they

*Valuable notes by Mr. G. Fielden on the same Birds of Trinidad and Tobago were published in the *Bulletin*, xiii. January, 1914, 25-33.

become equally injurious. In almost every country the rooks and starlings require *thinning out annually* [italics mine.] The rook has greatly increased during the past ten years, and it is common knowledge that where bird-life increases in this manner over a number of years, there is usually a change in the food-habits. From an insect-eating bird or at least a bird whose food consisted mainly of animal matter, it has become a grain feeder."

(5.) As the result of an investigation it was found that "the rook is not a particularly beneficial bird to the agriculturist although its usefulness might be considerably increased were it fewer in numbers."

From these quotations it will be seen that great emphasis is laid on the importance of thinning out, or reducing in numbers certain species of birds whenever they have increased to such an extent, that from being useful they become injurious to cultivated crops.

In order to be sure of what we are doing, and to avoid mistakes, information must be collected for several months, and even years, as to the food and habits of any species suspected of being injurious.

As regards paragraph (3) and its application to local circumstances, no doubt a great deal of the talk about the utility of birds is due to hearsay: there are not many species in Trinidad that can be called "beneficial,"—the great majority only affect the agriculturist to a slight extent, or not at all! Many are harmless but a few distinctly injurious. (See *General Notes on Birds—Part II.*)

It is difficult to assess the value of some birds, and this can only be done by thorough and systematic research extending over a long period. (See remarks under "Qu'est-ce-qu'il-dit.")

I think the case of the "corbeau" or "Johnny crow" (*Catharista atrata*) a fairly good example of what results can be accomplished by judicious thinning out. Until the authorities took steps to reduce their numbers by having them shot, these birds became so bold and fearless that they used to carry off young chickens from poultry yards in the city, it was also a risky thing to walk under the trees in the public squares; one was sure to be soiled by these filthy birds. This judicious thinning out has not in any way affected their value as scavengers as they are now confined to their proper sphere of utility.

BIRDS FREQUENTING CACAO FIELDS.

The writer is much indebted to Mr. Klages for being able to assess the value of these birds, the information has been given in tabulated form with short notes.

Other information which it has been thought might be useful, has been added at the foot of each table.

TABLE I.—BIRDS FREQUENTING CACAO FIELDS.

A.—USEFUL.			
Popular Names.	Scientific Name.	Food.	Remarks.
(1.) { (a.) Large brown creeper	<i>Dendroornis susurrans</i>	Larvæ of Beetles and other insects. Nymphs and eggs of hunting ants.	'Brown creepers' must be given first rank among birds where the cacao beetles frequent. (S. M. KLAGES.)
(b.) Mangeur de cacao	"		
(2.) { (a.) Small brown creeper	<i>Picolaptes</i> sp. formerly considered to be	Do.	
(b.) Charpentier rayé	<i>P. albolineatus</i> .		
(3.) Petit Mangeur de cacao	<i>Dendrocincla m. meruloides</i>	Insects	Has the same habits as the "Brown creepers."
(4.) { (a.) Bootootoo.	<i>Momotus bahamensis</i>	Caterpillars, Beetles, Scorpions, Spiders, Roaches, Berries & Seeds, (Castilloa seeds sometimes.)	This bird was accused of eating young cacao-pods, and was shot in numbers in a certain locality, this has proved to be a serious mistake. Common in Tobago and plentiful in several places in Trinidad.
(b.) King of the Woods.	"		
(c.) Mot-mot.	"		
(d.) Houtou.	"		
(5.) { (a.) Little red-headed woodpecker	<i>Dendrobates kirkii</i> , Muhl	Insects and grubs?	Mistaken for the "Red-naped Carpenter bird" (Chloroncrpes rubiginosus which is a pest.
(b.) Carpenter.	"		
(6.) { (a.) Pintade.	<i>Thamnophilus doliatus</i>	Insects	In general colouration resembles speckled woodpeckers. Has no red plumage.
(b.) Guinea-bird	"		
(c.) Speckled ant thrush.	"		
(7.) { (a.) Tick-bird.	<i>Crotophaga ani</i>	Bugs, Centipedes, Froghoppers, Ticks, and almost every kind of insect.	An old and well-known friend of very decided value to the agriculturist.
(b.) Old-witch.	"		

* *Nasica susurrans*.—Leotaud.

** Also known popularly as the "Blue-headed woodpecker." (See Table iii).

The "Brown Creepers," (Nos. 1 and 2) must be given first rank among birds where the cacao-beetles frequent.

These birds cling to the bark of the trees and mount by a series of jerks. They are squirrel-like in colour.

From what I have been able to gather in the course of conversation with some planters, these valuable birds must have suffered a good deal of persecution in the past. The name "Mangeur de Cacao," was undoubtedly given long ago, and like the old saying, "Give a dog a bad name and it will stick to him" it is probable that in some places these birds are still destroyed for damaging cacao, or most likely what has happened in many cases, the destruction of the injurious species has been entrusted to grossly ignorant and careless persons who have shot all the species indiscriminately.*

No. 3, the "Petit Mangeur de Cacao" is probably a very useful species, with similar habits to the "Brown Creepers."

No. 4, the "King of the Woods," has come in for a fair share of attention of recent years. -Messrs. Carr, Klages, and Fielden, have each devoted a good deal of time to the study of its habits.

A paper by Mr. A. B. Carr was published in the *Proceedings of the Agricultural Society, Trinidad and Tobago* for May, 1912, (Paper No. 505) accompanied by two plates, showing nesting-place and figure of the bird.

In this interesting contribution the following passage occurs. "They do not attack ripe, nearly ripe, or half ripe pods. It is, however, possible for them to pick and swallow small *chireros* by accident when catchinginsects perched on the pods."

Mr. Fielden says. "It has been unjustly accused of damaging cacao," -and in the *Mirror* of 6 October, 1911. "The food consists of insects and berries, the bird being especially fond of the seeds of the *Castilloa*."

In two specimens, suspected to have eaten cacao pods, which were dissected in the writer's presence, only insects and seeds were found.

Ornithologists unanimously agree that birds do not eat *unripe* fruit.

Mr. Klages thinks that the "King of the Woods" is probably very useful in the cacao groves. I am of opinion that an attempt should be made to establish this bird on any cacao estate where it does not now appear to frequent. It will live in captivity and can be easily transported long distances. Of course, as the bird builds in holes in banks, it is quite probable that the mongoose might interfere, but its introduction is certainly worth trying.

No. 5, the "Little red-headed woodpecker" is often mistaken for the pest, "The red-naped carpenter bird." (See Table iii.).

It is therefore unwise to entrust the destruction of the pests to any but an experienced and trustworthy person, and it is certain that every planter who values the future prospects of his property should make himself acquainted with all the facts connected with these birds. (See further notes at foot of Table iii.).

No. 6, the "Pintade," or "Guinea bird," (male) in general colouration resembles the speckled woodpeckers, but perches and moves about quite

* See Table III.

differently, and has no red plumage whatever. "It is quite innocent of any mischief to the cacao, and moreover, is probably a distinctly useful species." Both this and the "Brown Creepers" are frequently shot by persons mistaking them for "Carpenter birds." (S. M. Klages).

No. 7, the "Tick-bird," or "Old-witch," has been included, but this bird really prefers to frequent traces and open pastures rather than cacao groves. It is very fond of following "brushing gangs." The labourers with their slashing cutlasses disturb hordes of insects of all kinds that are eagerly seized by the birds following close on the heels of the brushing gangs.

The undermentioned list (Table ii.) of useful birds comprises some species that probably frequent cacao estates, but are not often seen on account of their nocturnal habits.

It is likely that when expert investigation is instituted, these "Night-jars," or "Goat-suckers," will be found to be of importance in regard to the natural control of the cacao beetle.

TABLE II.—BIRDS FREQUENTING CACAO-FIELDS.

B.—USEFUL.

Popular names.	Scientific names.	Food.	Remarks.
(1.) Poor-me-one (Goat-sucker)	... <i>Nyctibius jamaicensis</i> ...	Night beetles, fire-fly eaters principally.	The cacao beetle is a night flier, it is probable that these "night-jars" or "Goat-suckers" may have a good deal to do with the scarcity of beetles on certain estates.
(2.) Goatsucker or Night-jar	... <i>Chordeiles acutipennis</i> ...		
(3.) Do.	... <i>Lurocalis semitorquatus</i>	Moths,	
(4.) Do.	... <i>Podager nacunda</i> ...	beetles, and other night insects.	
(5.) "Da-who-you" "Goatsucker"	... <i>Nyctidromus (Caprimulgus) albicollis</i>...	.

These birds are seldom seen on account of secretive and nocturnal habits.

In the *Journal of the Trinidad Field Naturalists Club*, May 1894, Mr. A. B. Carr writes :—"The Poor-me-one [No. 1] calls only from February to June both months inclusive. It is strictly a nocturnal bird, feeding on night beetles, the large fire-fly being its chief victim."

About No. 5 ("Da-who-you" goatsucker) *Dr. Leotaud says "It keeps close to the ground near thickets. In the night it leaves its retreat to search for insects." It is common.

The term "goat-sucker," although very generally used, has no foundation, in fact, it has merely originated from a superstition that

* Leotaud, *Oiseaux de l'île de la Trinidad*.

these remarkable birds sucked the teats of goats. A very good name is "night-jar,"—as this name bears a certain analogy to the nature and qualities of the birds, which always appear at dusk and utter their jarring notes, it is certainly more applicable. These birds possess mouths of great comparative size to enable them to catch insects on the wing. When perched they usually sit on a bare twig with head lower than tail, and in a line with the branch, not cross-wise like other birds. They do not form any nest, but merely lay their eggs on a suitable spot on the ground.

I have seen a species of night jar (probably No. 5) which would rise quite close to a person and skim about within a few feet, uttering a sort of jarring note; this was observed during moonlight nights.

Doubtless the mongoose has destroyed numbers of these useful birds not only "Night jars" but "King of the Woods," owing to their egg-laying and nesting habits, and so indirectly has had a good deal to do with the increase and spread of the cacao-beetle.

Of course there are several other species of birds that are to be seen in and around our cacao groves, and they are mostly no doubt quite harmless, probably some more or less useful, but the object of the writer is to indicate those that can be really classed as beneficial, *i.e.* of sufficient economic importance to point out as natural controlling agents of that most troublesome pest of the cacao planter, the cacao beetle.

Most of the other cacao pests have their own insect enemies that keep them in check, but it has always seemed to me from the habits of the cacao beetle that certain birds must be the principal *controlling agents; it is therefore with the object of rousing interest in this aspect of the problem that I bring the matter forward.

The "Jacamar," (*Galbula ruficauda*) is often seen among the cacao trees perched on a bare branch overlooking an open space, where it can best take a passing insect on the wing. It is a beautiful creature and may be classed as useful,—for æsthetic reasons alone it should be protected. This latter observation also applies to "Humming birds," which should all be protected. They live on the nectar, as well as the numerous small insects contained in flowers. I have also seen "Humming birds" taking minute insects on the wing,—darting to and fro among the small flies hovering in the air and apparently much enjoying this method of capturing their prey. Probably a good many *Simulium* flies are consumed in this way. It should certainly be classed as a heinous crime to destroy any of these beautiful creatures, as they would seem to be quite as useful as they are beautiful. There are certain species of owls which are doubtless useful in consuming vermin.

I have frequently seen the "Yellow tail," (*Ostinops decumanus*) on immortal trees (*Erythrina* sp.); but do not think it is of any use,—it is an interesting bird and probably quite harmless to cacao,—but it is injurious in orchards. Stomachs of these birds have been examined by Mr. Klages, who has been unable to find any insects in them,—they are mainly frugivorous.

* See Circular, Board of Agriculture, No. 1, May, 1911. *Life history, and control of the Cacao Beetle*, page 19. "The well-known behaviour of the beetles indicates clearly that birds are their principal enemies."

† *Coerebidae*.

Mr. Fielden (p. 26) says "it is practically omnivorous, devouring insects, fruit or seeds with equal avidity."

HARMFUL BIRDS.—Only three species of harmful birds have been included in this list of those frequenting cacao fields. When we know exactly what birds are responsible for the dissemination of the so-called "Bird-vine," these will also have to be classed as harmful. It is probable that among them are certain * "Honey-creepers" and some of the smaller Tanagers, Warblers, &c.

TABLE III.—BIRDS FREQUENTING CACAO FIELDS.

HARMFUL.

Popular Name.	Scientific Name.	Damage done.	Remarks.
(1.) { (a.) Red-naped carpenter (b.) Blue-headed woodpecker	<i>Chloronerpes rubiginosus</i> . Swains.	Perforate cacao pods.	"Neither of these species are in any way necessary to agriculturists: both are pests and should be treated as vermin." S. M. Klages.
(2.) Large red-headed carpenter-bird.	<i>Melanerpes tricolor</i> .	Do.	
(3.) Carpenter Bird.	<i>Centurus terricolor</i>	Do.	"An out and out pest pretty well 50 per cent. of the ripe pods are attacked" Tobago. W. E. BROADWAY.

These three birds are harmful to cacao in Tobago. No. 1 only in Trinidad.

After most careful observation of habits and examination of stomach contents, Mr. Klages has come to the conclusion that these birds are undoubtedly pests and should be treated as such. The confusion that existed in regard to "Carpenter-birds" can be seen on reference to Circular No. 2, Department of Agriculture, published in 1909.

The close superficial resemblance between the "Little red-headed woodpecker" (No. 5, Table I), and the "Red-naped carpenter-bird" (No. 1 Table III), makes it difficult for the planter to select anyone careful enough to entrust with the responsible task of shooting the harmful bird.

The difference between the former (the useful bird) and the latter (the harmful one) cannot be detected at a distance, nor is there any difference in their movements among the cacao trees which would help. At short range the markings on the head can be relied on to distinguish them. The former has a *red-head* as its popular name indicates. The latter has a *red-nape* (*red around the back of the neck*), and a *blue crown*. Of course, these the principal superficial differences, are not easily made out some way off. It will therefore be understood, that it is absolutely

* *Simulium*—"Sand-fly."

necessary for every planter who values the future prospects of his cultivation, to make himself thoroughly acquainted with all the facts connected with these birds, and any others with similar habits that frequent the cacao.

Other birds besides the harmful ones enumerated in the above Table are fond of the pulp surrounding the cacao beans, among them may be mentioned the "Ant-thrush" or "Pintade" (Table I, No. 6) and the "King of the Woods."

(Table I, No. 4), but these birds never attempt to *perforate a pod* for the purpose of getting at the pulp, they only take advantage of any hole already there. The King-of-the-Woods frequently scatters the contents of a perforated pod, sometimes carrying the beans some distance away, and often placing them in situations where they soon germinate.

BIRDS AFFECTING THE SUGAR-PLANTER.

These are remarkably few in number—and it can hardly be said that they frequent the cane-fields so as to be of any practical use against the principal pests that are troublesome; at any rate, under conditions that exist at present.

TABLE IV. BIRDS USEFUL TO THE SUGAR-PLANTER

Popular Name.	Scientific Name.	Food.	Remarks.
(1) Boat-tail or Barbados Blackbird	<i>Quiscalus fortirostris</i>	Insects generally Ticks. Dipterous. larvae.	Most useful in cleaning cattle of ticks.
* (2) Tick bird Oldwitch or Merle corbeau	<i>Crotophaga ani</i>	Insects generally Froghoppers. Ticks, Bugs.	Sp. Circular No. 4 Dept., of Agri., March, 1918, froghoppers found in stomach. Circular No. 9 Board of Agri., July, 1918.
(3) Scissors-tail fly-catcher or Longe-queue.	<i>Milvulus tyrannus</i>	Froghoppers and other Insects.	Migratory. Circular No. 9, Board of Agri. 18 July, 1918.

The value of Nos. 1 and 2 is mostly to be appreciated in an indirect manner, *i.e.*, they help to keep the live stock free from ticks. No. 1, the Barbados Blackbird, is especially efficient in this line as it will clean off the smallest ticks, No. 2, the Oldwitch is a lazier bird and prefers to feed on insects disturbed by the cattle moving along the grass. It is also exceedingly fond of following brushing and weeding gangs.

* Special Circular No. 4, Froghoppers by J. C. Kershaw 3/3/13. "The planting of trees and shrubs on the waste grounds adjoining cane-fields would encourage the spread of these and other useful birds."

No. 3, "the Scissors' tail" is a migratory bird visiting us during the time of year when insects are most abundant, from about early July to November, and then returns to the Spanish Main. These birds are very fond of alighting on black-sage bushes *Cordia cylindrostachya* near cane-fields.

Birds under present conditions are, however, only a small help to the planter, for one thing they do not like the closed in, heated atmosphere of a thickly grown cane-field, another thing there is not enough cover in the shape of suitable trees to encourage them.

A few notes on the kind of situations selected as breeding places by these birds will show the need for proper cover being provided if they are to be attracted to the cane-fields.

No. 1, (the Barbados Blackbird) which is seen and heard at every step in Barbados, although plentiful here in Trinidad, has not increased as rapidly as is desired.

I was able to find out something about its nesting-habits while in Barbados in July, 1913. It builds a rather neat bowl-shaped nest of dried grass mixed with horse hair, and any convenient bits of material.

I saw nests placed rather high up, at the ends of branches; trees with rather thick foliage are chosen to build on, such as fiddlewood, and tamarind, and I was told that the cabbage palm or palmiste (*oreodoxa oleracea*) was also a favourite.

The eggs are light blue, with large and small spots and lines, at the thick end. Some eggs have the spots more scattered, and sometimes the spots are connected with lines resembling small ink-blots joined by hair lines. Egg-measurement about $23\frac{1}{2}$ m.m. ($1\frac{1}{8}$ of an inch) by $18\frac{1}{2}$ m.m. in width ($\frac{3}{4}$ of an inch).

The "old witch" builds in thick bushes a few feet from the ground. The females co-operate in building large nests in which they lay and sit together. They breed several times in one year.

The "*Qu'est-ce-qu'il-dit*." Of birds that are heard around most places in Trinidad the "*qu'est-ce-qu'il-dit*" is perhaps best known on account of its noisy call.

There are four species that come under this popular name. They are considered insectivorous.

From what I know of two of these species however they are omnivorous, these are (a) the commonest one *Pitangus sulphuratus* with white around crown of head (appears like stripes on each side of head) and (b) the other common one called the "grey-headed *qu'est-ce-qu'il-dit*" (*Tyrannus verticalis* Leot.)

In fact the former species (a) is very fond of "peppers" (*T. Melancholicus Satrapa*, Licht. *Capsicum* spp.) I have seen this bird pecking to pieces peppers that were too large to swallow whole, and these were of such an exceedingly hot variety that I did not care to use them for the table, smaller kinds ("bird-peppers") it swallows at a gulp. It is also much addicted to eating small lizards. Strict watch must be kept

**Megarhynchos chrysogaster*, Sci. very much resembles this bird superficially, but the bill is broader and it appears to be rarer. = "*Qu'est-ce-qu'il-dit-a bec large*."

**Saurophaus sulphuratus*, Linn. = "*Qu'est-ce-qu'il-dit-a bec etroit*."

on this ubiquitous bird wherever there is an apiary, the industrious honey bee forms a favourite part of its diet. On the whole it may be said that this bird likes to hang around human habitations where it can get a living with as little trouble as possible.

I believe the "grey-headed qu'est-ce-qu'il-dit" to be just as omnivorous, in fact they are both such indiscriminate feeders that it is difficult to say whether they can be considered beneficial birds, except perhaps under special circumstances where conditions may compel them to eat injurious insects only.

These remarks on "qu'est-ce-qu'il-dits" apply to many birds which in the popular mind are considered "useful." What we want is expert investigation extending over a long period detailing stomach contents of the important species, collected from different localities and at different seasons.

I have seen the common "qu'est-ce-qu'il-dit" attack *Castnia licus* moths (Giant moth borer) on two occasions but not in the cane-fields: and I am of opinion that it was just because the moths happened to fly past within view of the bird as it was perched on a tree near by. Whether these "qu'est-ce qu'il-dits" and similar omnivorous birds could ever be induced to frequent canefields more than they do now, would I think depend a good deal on the "bird-reserve" question. Most of these birds build their nests high-up in thick foliage trees and palms and anything in the nature of cover for them is to be recommended, it is not only for birds that reserves will be useful, but the various insect-enemies of the insect pests we suffer from.

SUMMARY AND RECOMMENDATIONS.

In comparison with the large number of birds recorded for Trinidad, there are really only a few species that materially affect the cacao and sugar planters, the most important of these are given in Tables I, II, III and IV. The useful species, (Tables I, II and IV) should be offered every inducement and protection. Some suggestions which the writer thinks would be of value, if carried out, are here offered.

CACAO.

As regards providing cover for birds on cacao estates it may be argued that the groves with their shade trees give shelter enough, but this to my mind is not sufficient, the principal birds of value to the agriculturist would prefer belts of highwood where they would be undisturbed during breeding seasons and from which they could wander into the cacao groves.

Too much has been done in the way of stripping extensive areas of all natural cover. Suitable windbelts replacing stunted and unprofitable cacao trees would pay better in the long run rather than leave things as they are at present.—in fact there are certain trees of economic value which would answer very well as cover for birds and induce them to remain near our cacao groves.

Planters are advised to be extremely cautious about entrusting the thinning out of the † "Red-naped carpenter bird" to any but experienced

*See *Special Circular No. 4*, Department of Agriculture, March, 1913, also *Circular No. 9*, Board of Agriculture, July 1913.

† "Blue-headed Carpenter bird," (*Chloronerpes rubiginosus*).

and trustworthy persons. It so closely resembles the * "Red-headed woodpecker," one of the useful species, that it is difficult to tell the difference between the two birds at a distance, as they both have the same superficial resemblance and movements among the cacao trees.

It is advisable not to pay a price per head, or even to pay specially by offering a reward for shooting the harmful birds. It is obvious that this would only encourage indiscriminate slaughter. All the birds shot each day should be seen by the manager or owner of the estate, so as to avoid the repetition of any error, in case the wrong bird is shot.

Before, or during the season when the fruit of the bird-vines ripen, the small birds that feed on the seed should be thinned down. This would no doubt prevent the present rapid spread of these † parasites which sap the vitality of the cacao trees.

The usual old-fashioned gun, or fowling piece, is too noisy and should never be used for shooting around cacao,—suitable bird-guns can easily be obtained that make very little noise, or even a small rifle fitted with shot cartridges would do, or even a good class of air-gun.

Certain "Night-jars" and the "King of the Woods," lay eggs on, or in holes in the ground,—and it is quite clear that the mongoose can, and does get at these, with the result that in many districts these birds must be seriously decimated, in consequence the cacao beetle (*Stirastoma depressum*) and such like pests, have increased in numbers, mainly due to the absence of the natural control by these insectivorous birds.

Every effort should be made to exterminate the mongoose.

Much good can be done by all estates paying a reward to labourers,—about 1/- per head, according to the prevalence of the pest in each district. I have heard that dogs can be trained to hunt them with good results. I have not studied the habits of the mongoose sufficiently to say whether breeding them for the purpose of releasing *males only* would help to diminish their numbers.

Various experiments have been conducted, and I believe are still being carried on by Mr. Ulrich, with a view of ascertaining whether this pest cannot be destroyed in a more effectual way than by any of the usual methods which have hitherto proved both expensive and unreliable.

SUGAR.

On sugar estates the creation of bird reserves is advisable,—that is to say, the very extensive areas that lie bare and uncovered without a break, should no longer be allowed to exist. There should be some thick bushy trees and shrubs between certain blocks at certain spots,—where owing to natural depressions in the contour of the surrounding country, water would generally collect and be retained, such situations should be selected for planting suitable trees.

On flat lands without any undulations a systematic planting up of narrow belts of trees at certain distances would have to be adopted.

* "Red-headed Woodpecker," (*Dendrobates kirkii*).

† The term "Parasite" is often wrongly applied locally to orchids with pine (Bromeliads), etc., the so-called bird-vine is a true botanical parasite.

It must be borne in mind that these *reserves would not be for useful birds alone, but what is more important insect-ennemies of those insects that cause loss to the planter.

The whole subject of the value of birds to the agriculturist should occupy the attention of an † Economic Zoologist for a considerable length of time. I am sure the results would mean a saving of considerable sums of money to planters.

The work must be done specifically, it will not do to tack it on to an officer with other work on hand.

The spread of "bird-vine" alone costs our planters a great deal to check, and it can be controlled to a considerable extent by a judicious thinning out of the birds that distribute this troublesome parasite. (See Part II, "*Birds injurious in other ways.*")

The bird-question should be gone into thoroughly, and the writer of these notes will have gained his object if he succeeds in arousing additional interest in this important subject.

(To be continued.)

* See *Special Circular*, No. 4, Department of Agriculture, March, 1913, and Circular No. 9, Board of Agriculture, July, 1913, p. 27.

† Entomologists are Economic Zoologists.

LIVE STOCK AND POULTRY.

GOVERNMENT FARM ANNUAL SALE, 1914.

The thirty-first Annual Sale of Surplus Stock of the Government Farm, Trinidad, took place on February 27, when the following range of prices was obtained for animals in the following classes. This was the first sale at which sufficient Holstein cattle were available to allow of some being offered for sale.

The total receipts for the sale were \$3,807.75 (£751 12 3½).

3 Pure Bred Zebu Bulls	...	Averaged	...	\$144.00
2 Do. Heifers	...	"	...	44.00
2 Do. Cows	...	"	...	48.50
2 Cross Bred Cingalese Cows	...	"	...	36.00
9 Three-quarter Bred Zebu Heifers...	...	"	...	22.50
11 Half-bred Zebu Heifers	...	"	...	19.50
5 Half-bred Red Poll Heifers	...	"	...	39.00
2 Half-bred Holstein Heifers	...	"	...	49.00
1 Half-bred Hereford Heifer	...	"	...	55.00
8 Three-quarter Bred Zebu Bulls	...	"	...	45.00
6 Half-bred Zebu Bulls	...	"	...	29.50
9 Half-bred Red Poll Bulls	...	"	...	40.50
5 Half-bred Holstein Bulls	...	"	...	41.50
1 Half-bred Jersey Bull	...	"	...	26.00
4 Pairs young Working Oxen	...	per pair	...	148.50
8 Milch Cows	...	averaged	...	32.50

The trios of poultry sold from \$8.75 to \$12.25; pairs (cock and hen) \$5.75 to \$6.25 and cockerels \$2.00 to \$4.25.

No pigs were offered, the demand for young pigs throughout the year being so keen that orders were booked in advance.

MILCH GOAT BREEDERS IN THE UNITED STATES.

The Bureau of Animal Industry of the United States Department of Agriculture in response to an enquiry as to sources of good breeds of milch goats has courteously furnished the following list of milch goat breeders in the United States, showing the kinds of goats bred by each. The numbers in the last column refer to the breeds, as follows:—1, Toggenburg ;

2. Saanen; 3, Italian; 4, Spanish Maltese; 5, Nubian; 6, Schwartzburg-Guggisberger; 7, Austrian; 8, Angora (for milk); 9 Grades.

Name and address of breeder.	Number.	Kind of goats.
ARKANSAS.		
Paul Geinne, Baker Springs	200	1, 2.
CALIFORNIA.		
S. H. Bowman, Paso Robles	5	9,
L. A. Bridinger, Santa Rosa	10	1, 2,
C. S. Decker, Englewood	7	1, 9.
Carl W. Fisher, San Mateo	5	9.
Dr. R. J. Gregg, San Ysidro	125	1, 5.
D. E. Long, Pasadena	1	9,
Dr. S. L. Roberts, Lemon Grove	24	1, 9.
J. Courtland Scott, Los Angeles, Care Dist. Atty.	18	1, 2.
Miss H. A. Wood, Pasadena	20	1, 9.
CONNECTICUT.		
Leo Real, Mansfield Depôt	6	1.
FLORIDA.		
C. A. Hedges, Ruskin	150	2, 9.
Charles F. Morrison, Appopka	7	1, 2, 5.
GEORGIA.		
R. M. Doty, Americus	12	2, 4.
ILLINOIS.		
A. C. Ball, Pontiac	7	9.
Col. George Fish, Joliet	200	1, 2, 4.
George McGuire, West Pullman	85	Russian Maltese.
INDIANA.		
Eliza Hubbard, Farmland	13	9.
William C. Shirley, Orleans	14	1, 2, 4.
IOWA.		
M. A. Miller, Dayton	49	1, 4.
KANSAS.		
H. L. Latham, Winifield	4	1, 9.
C. F. Pfeutze, Manhattan	8	1.
G. H. Wickersham, 2,914, E. Central Avenue, Wichita.	4	1, 2, 4.
MASSACHUSETTS.		
Ambler Goat Dairy, Kendall Green	72	1, 2, 5, 4, 9.
C. R. McGuire, Merrimac	8	1, 9.
Mary S. Packard, Seekonk	18	1, 9.
W. G. Todd, East Bridgewater	78	1, 2.
Waltham Goat Dairy, Waltham	12	1, 2, 4, 9.

Name and address of breeder.	Number.	Kind of goats.
MICHIGAN.		
J. S. Cornins, Battle Creek, R.F.D. 6. Box 64	26	1, 2, 6.
Samuel P. Hertzter, Glennie ...	5	1.
MISSISSIPPI.		
W. H. Bou-log, Gulfport ...	11	9.
MISSOURI.		
D. W. A. Kendall, Poplar Bluff ...	6	9.
H. H. Klaus, Wellston, R.F.D. 28, Box 28-A	7	1, 2, 4.
Dr. John M. Tracy, Mound City ...	4	1.
NEBRASKA.		
Edwin C. Miller, Lincoln, Box 754	12	1, 9
NEW YORK.		
Mrs. C. P. Dreyer, Wantagh ...	7	1, 9.
Emma E. Hunnikin, Schneckedy, R.F.D. 49	12	2, 9.
William Strehler, Kinderhook ..	6	1, 2.
NORTH CAROLINA.		
F. W. Hossfield, Morganton ...	28	1, 9.
OHIO.		
A. C. Buchwalter, Weilersville ...	10	1.
J. C. Darst, Dayton ...	24	1.
D. A. Kraus, Wooster ...	2	9.
Mrs. A. W. Lee, Toledo ..	10	2.
E. J. Lemon, D.D.S. Elmore ...	11	1, 2, 9.
N. A. May, Youngtown, R.F.D. 4, Bryan Avenue	4	1.
D. S. Zook, Wooster, R.F.D. 3	6	1.
OREGON.		
Albert Teal, Falls City ...	41	1, 9.
PENNSYLVANIA.		
J. W. Beecher, Pottsville ...	15	9.
Mrs. M. P. Bruggeman, Beaver Falls, R.F.D. 4	7	2, 9.
G. R. Garrison, Haysville ...	18	1, 2, 9.
C. W. Griggs, Trout Run ...	90	1, 2, 5, 9.
J. R. Heiwig, Crowl ...	8	1, 9.
Will H. Miller, Indian School, Carlisle ...	8	2.
E. S. Sharples, Newtown ...	50	1, 2, 9.
TEXAS.		
H. C. Gillean, Frost ...	9	1, 2.
VERMONT.		
Thayer & Son, D.M., Bellows Falls ...	10	1, 2, 5.
VIRGINIA.		
Bonnie Brier Cheviene, Cassanova ...	8	1, 6.
WASHINGTON.		
Lawton and Johnok, Edmonds ...	20	1.
WISCONSIN.		
H. R. Boese, Milwaukee ...	26	2, 9,
CANADA.		
P. A. McIntosh, M.D., Spencerville, Ontario	4	1.

AGRICULTURAL BANKS.

CO-OPERATIVE CREDIT IN INDIA.

The *Journal of the Board of Agriculture* of Great Britain. Vol. XIX. 1912—13. pp. 948-949 contains an interesting summary of recent progress of Co-operative Credit Societies in that country :—

“The satisfactory result is due mainly to the success of the societies in obtaining advances and deposits, either from members or non-members, at a considerably lower rate of interest than they charge on loans to their members. The rates which the societies find it necessary to pay in order to secure the capital required for their working vary from about 6 to 10 per cent., and average something like 7 per cent., for the whole of India ; and the rates charged by the societies on loans made to their members vary from about 10 to 15 per cent., and average for the whole of India approximately 12 per cent. The amount of interest earned by societies during the year exceeded the amount of interest paid by them by £45,000, which left them a margin of profit of nearly 5 per cent. on the amount borrowed by them from all sources ; and as the committees which manage these societies perform their work without payment, the total cost of administration for the whole of India came only to £8,000, or a little more than £1 per society for the year. Thus the members of these societies have not only found them a safe place of deposit for their savings, but have been able to borrow the small loans they require at a rate of interest which, though it seems high in comparison with the rates current in western countries, is only about half the rate they used to pay to the village money-lender. The more successful societies, which have built up a large reserve fund, are now beginning to reduce the rate of interest they charge on loans to their members.

“The indirect advantages of the movement are also very marked. The establishment in a village of a successful credit society among the peasants themselves have greatly reduced the demand for loans from the village money-lender and compelled him to lower the interest he charges to other persons who still resort to him for loans. The manifest benefits gained from co-operation in the matter of credit are encouraging the villagers to combine for other purposes, and one hears of co-operative societies formed for the provision of good seed or improved implements, for the purchase of members requirement, and for the sale of their produce. Some societies have even begun to take up land for demonstration farms, to build village halls, and to start village schools for the benefit of their children. It is also noted that these societies play an important part in the prevention of disputes and litigation, and bring the people together in friendly fashion, so that the practice of co-operation is having a marked influence on the effacement of old enmities and the development of social intercourse among the villagers. The movement is rapidly spreading, and promises to revolutionise village economy throughout the country, by increasing the welfare and raising the intellectual and moral standard of the masses of the people.

"The Government of India has now acquired a wide experience of its own in the matter of agricultural co-operation, and last year, in accordance with that experience, amended the law on the subject and passed an Act, "for the promotion of thrift and self-help among agriculturists, artisans, and persons of limited means," by encouraging the formation of societies which have as their object the promotion of the economic interests of their members in accordance with co-operative principles. This Act applies to all forms of co-operation, but in the meantime it will chiefly affect co-operative credit societies, which so far in India have usually been based on the principle of unlimited liability of the members for the debts of the society; indeed, of the 7,562 rural societies, 7,239 are formed on this principle. Provision is, however, made for societies with share capital, and limited liability. The societies which are mainly composed of peasants who can neither read nor write, are placed under the control of the local Government acting through the Registrar of each province, who has power to refuse registration, to criticise a society's rules to require it to have its accounts audited by some person authorised by him, and to wind up compulsorily any society whose affairs are mismanaged. On the other hand, the societies are given certain privileges, such as exemption from income tax and stamp duties, priority over other creditors in certain cases when enforcing demands due from members, exemption of members' shares in the society from attachment or sale under a decree of court, and the right of members to nominate persons to whom their shares shall pass on their death. The members greatly value the audit, inspection, and advice of the official staff (almost entirely composed of Indians,) who travel about the country, examining the affairs of existing societies, and aiding in the establishment of new ones."

It is worthy of special note that the greater number of these Indian banks are small rural societies composed of peasants and worked on the principle of unlimited liability of the members. They are in fact, of the same type as those of St. Vincent to which attention has recently been directed as being probably the best model for Trinidad and Tobago.

BOARD OF AGRICULTURE.

Statement of Revenue and Expenditure from January 1, to December 31, 1913, compared with Estimates.

REVENUE.		EXPENDITURE.		
			<i>Actual.</i>	<i>Estimated.</i>
To Ag. Tax on Cacao ...	\$ 9,533.66	By Salaries...	\$ 8,920.00	\$10,120.00
" " " " Sugar ...	729.30	" Laboratory ...	499.26	500.00
" " " " Coconuts ...	773.10	" Library ...	119.56	140.00
" " " " Copia ...	442.50	" Office Contingencies ...	159.85	160.00
Sale of "Dusters" ...	38.84	" Disease Prevention ...	497.90	500.00
" Potatoes from } ...	66.50	" Illustrations, &c., ...	189.24	200.00
" Cane Nursery } ...	30	" Travelling Expenses ...	1,080.38	1,200.00
" Ballou's Book ...	72	" Rubber Tapping } ...	2.10	240.00
" Handbooks of } ...	414.00	" Experiments } ...	1,306.78	1,360.00(a)
" Nitrolim ...	13.12	" Prizes for Improved Cacao Cultivation ...	48.00	48.00
Refund from Chief Inspector Plant Protection Ordinance of Advance }		" Auditing Accounts ...	1,148.10	1,400.00
		" Estates Experiments ...	457.25	476.00(b)
		" Sugar Cane Nursery ...	13.12	48.00(c)
		" Plant Protection Ord'nce (Advance) ...	240.00	250.00
		" Imperial Bureau of Entomology Contribution ...	...	320.00
		Permanent Nitrate ...	...	1,000.00
		Com. Experiments ...	...	...
		Emergency vote ...	...	...
Total Revenue ...	\$16,012.04	Total Expenditure...	\$14,681.54	\$17,962.00
To Refund by Brunton } ...	60.00	By Cash at Colonial Bank }	7,351.08	
" " on pro-note }		" Cash on hand ...	7.27	
" " by Farfan on } ...	100.00			
" " pro-note }				
Balance in hand on January 1, 1913 }	5,867.85			
Total ...	\$22,039.89	Total ...	\$22,039.89	

(a) Extra Vote for \$400 ...

See Minutes 20/6/13.

(b) Extra Vote for \$476 ...

See Minutes 20/12/12 \$400 and 17/10/13 \$96.

(c) Extra Vote for \$40 ...

See Minutes 18/4/13.

(Sgd.) A. DEVENISH,

Secretary

January 20, 1913.

Examined and found correct,

(Sgd.) R. G. BUSHE,

Auditor-General,

March 10, 1914.

BOARD OF AGRICULTURE.

Estimates of Revenue and Expenditure, January 1, to
December 31, 1914.

Adopted at a meeting of the Board of Agriculture, January 16, 1914

<i>Revenue.</i>		<i>Expenditure.</i>	
By balance in hand on Jan., 1, 1914 ...	\$ 7,358.35	Salaries ...	\$9,160.00
„ Estimated Tax on Cacao \$6,250.00		Laboratory ...	600.00
„ Estimated Tax on Sugar 3,480.00		Library ...	140.00
„ Estimated Tax on Coconuts 562.00		Office Contingencies ...	200.00
„ Estimated Tax on Copra 138.00	\$10,430.00	Disease Prevention ...	500.00
		Illustrations, &c. ...	200.00
		Travelling Expenses ...	1,000.00
		Advance towards Sugar	
		Cane Nursery ...	240.00
		Prizes for Improved	
		Cacao Cultivation ...	1,400.00
		Auditing Accounts ...	48.00
		Estates Experiments ...	1,200.00
		Imperial Bureau of En-	
		tomology Contribution	240.00
		Permanent Nitrate Com-	
		mittee Experiments ...	320.00
		Emergency Vote ...	1,000.00
			<hr/>
	\$17,788.35		\$16,248.00

NOTES.

At the meeting of the Board of Agriculture, on March 20, it was decided, on the motion of the Acting Director of Agriculture, to replace the present "Manurial Experiments' Committee" by an "Experiments' Committee" to be an advisory body on the experimental work carried on by the Department of Agriculture and the Officers of the Board.

The object of the suggestion is to secure greater co-operation between the planters and the Agricultural Officers of the Colony.

The Department has a supply of seed corn from cobs of selected plants, for sale at five cents per lb. Application should be made to the Curator, St. Clair Experiment Station.

The meteorological returns (pp. 137-8) indicate that for the first quarter of 1914 the rainfall has been very low in many districts of the Colony, and as a general rule much below that of the corresponding period of 1913. Throughout the low country the falls have been very light, with the usual striking exception of Caroni; *e.g.* Port-of-Spain 1.51 to 2.39 (four stations), St. Joseph 2.24 to 2.78 (two stations), Carapichaima 3.37 to 4.26 (two stations), Couva 1.28 to 2.38 (eight stations), Naparima 2.01 to 4.11 (eight stations.) Even in such wet districts as Sangre Grande, Tamana and the North Coast the fall from January to March, 1914, is in several cases only one half, or even one third of that for the same period of 1913.

The Department has imported a special supply of tobacco seed, Application should be made to the Curator, St. Clair Experiment Station, or to the Curator, Botanic Station, Tobago.

Pending the appointment of a successor to Mr. C. H. Wright, the work of the Agricultural Science Master is being conducted by Mr. A. E. Collens.

The Agricultural Fires Protection Committee of the Board of Agriculture presented its report to the March meeting. The report was discussed at the April meeting of the Board and adopted after a few alterations had been made.

METEOROLOGY.

RAINFALL RETURN FOR JANUARY TO MARCH, 1914.

Stations.	FEBRUARY.		JAN. TO FEB.		MARCH.		JAN. TO MAR.	
	1914.	1913.	1914.	1913.	1914.	1913.	1914.	1913.
<i>North-west District.</i>								
	In.	In.	In.	In.	In.	In.	In.	In.
St. Clair—Royal Botanic Gardens ...	0.61	0.50	1.11	3.30	1.28	1.42	2.39	4.72
Port-of-Spain—Colonial Hospital ...	1.04	Nil	1.45	2.92	0.06	1.13	1.51	4.05
Royal Gaol ...	1.31	0.57	1.82	3.46	0.07	1.61	1.89	5.07
Constabulary Hdqrs. ...	1.49	0.86	2.17	3.69	0.02	1.47	2.19	5.16
St. Ann's—Reservoir ...	1.66	0.31	2.15	3.83	0.85	1.50	3.00	5.33
Maraval—	1.52	0.83	2.15	4.67	1.95	1.25	4.08	5.92
Constabulary Station ...	1.07	0.71	1.67	5.00	1.38	1.29	3.05	6.29
Diego Martin—Constabulary Station ...	1.23	1.76	1.66	5.31	1.38	1.08	3.01	6.39
Waterworks ...	0.80	1.32	1.66	5.48	1.30	1.39	2.96	6.87
River estate ...	0.96	1.64	1.54	5.43	1.18	1.33	2.72	6.86
Fort George Signal Station ...	1.26	1.06	1.91	3.75	2.21	1.64	4.12	5.39
North Post ...	1.00	0.71	1.88	3.49	0.94	2.66	2.82	6.15
Carenage Constabulary Station ...	1.08	0.73	1.71	3.16	2.70	3.95	4.41	7.11
Carrera Island Convict Depot ...	0.80	0.98	1.62	2.47	0.24	1.49	1.86	3.96
Chacachacare Lighthouse ...	1.08	0.73	1.92	3.49	0.98	1.45	2.90	4.94
<i>Santa Cruz—Maracas District.</i>								
Santa Cruz—Constabulary Station ...	1.41	1.24	2.19	6.27	1.33	1.46	3.52	7.73
St. Joseph—Government Farm ...	1.38	Nil	2.47	3.85	0.31	1.97	2.78	5.82
Constabulary Station ...	1.56	0.32	2.14	3.14	0.10	1.70	2.24	4.84
Tunapuna—St. Augustine estate ...	1.76	0.26	2.92	3.01	0.15	1.16	3.07	4.20
Maracas—Government School ...	1.15	1.47	2.47	7.81	1.05	2.49	3.52	10.30
Ortinsula estate ...	2.99	2.07	4.34	7.57	0.86	2.22	5.20	9.79
Caura—Wardour estate ...	1.44	1.24	2.60	4.90	0.69	1.30	3.29	6.20
<i>West Central District.</i>								
Caroni—Frederick estate ...	3.10	2.50	9.08	12.12	1.90	3.79	10.98	15.91
Chaguanas—Constabulary Station ...	1.98	0.70	3.45	5.69	0.45	2.26	3.90	7.95
Woodford Lodge estate ...	2.20	0.47	3.76	5.92	0.34	1.92	4.10	7.84
Carapichaima—Waterloo estate ...	1.69	0.07	2.92	7.01	0.45	1.50	3.37	8.51
Friendship Hall estate ...	2.45	1.15	3.69	7.92	0.57	2.12	4.26	10.04
Couva—Exchange estate ...	0.66	0.45	1.45	5.54	0.23	0.63	1.68	6.17
Brechin Castle estate ...	1.06	0.56	2.20	6.44	0.26	1.00	2.46	7.44
Perseverance ...	1.57	0.56	2.50	5.60	0.39	0.92	2.89	6.52
Camden ...	0.97	0.53	1.55	8.15	*	0.65	*	8.80
Milton ...	0.47	0.36	1.48	6.08	0.10	0.78	1.58	6.86
Spring ...	1.93	0.79	2.98	7.58	Nil	1.84	2.98	9.42
Constabulary Station ...	0.34	0.10	1.18	4.59	0.42	0.60	1.60	5.19
Esperanza estate, Savonetta ...	0.33	0.27	1.28	6.50	Nil	0.61	1.28	7.11
<i>San Fernando & Princes Town District.</i>								
Claxton's Bay—Forres Park estate ...	0.88	0.16	1.76	6.98	0.17	0.61	1.93	7.59
Pointe-à-Pierre—Bonne Aventure est. ...	2.16	0.52	3.63	7.58	0.32	1.27	3.95	8.85
Concord estate ...	2.20	0.33	3.22	8.18	0.34	1.37	3.66	9.55
Plein Palais estate ...	0.76	0.18	1.62	6.92	0.21	0.70	1.83	7.62
Naparima—Picton estate ...	1.75	0.71	2.39	5.04	1.30	1.42	3.69	6.46
Usine St. Madeleine estate ...	0.88	0.91	1.86	8.14	0.94	1.43	2.89	9.57
La Fortune estate ...	1.22	1.02	1.87	6.11	0.78	1.11	2.65	7.22
Lewisville, San Fernando ...	1.32	0.67	2.78	8.72	0.70	1.67	3.48	10.39
Tarouba estate ...	0.78	0.22	1.73	5.59	0.28	0.97	2.01	6.56
Union Hall ...	1.35	0.31	2.59	4.50	0.53	1.11	3.12	5.61
Palmiste ...	1.33	0.65	2.19	6.33	0.63	1.40	2.82	7.73
Hermitage ...	2.67	0.74	2.85	5.16	1.26	1.44	4.11	6.30
Princes Town—Craignish ...	2.70	0.64	4.16	6.39	1.23	2.04	5.39	8.43
Cedar Hill estate ...	1.83	0.37	3.77	5.58	1.47	1.91	5.24	7.49
Williamsville estate ...	2.16	0.52	5.18	7.93	0.81	2.17	5.99	10.10
Esmeralda Estate ...	3.41	...	5.45	...	0.32	1.71	5.77	...
New Grant estate ...	2.31	1.25	4.75	7.70	1.34	2.70	6.09	10.40
Constabulary Station ...	0.91	0.49	1.85	5.46	0.69	1.89	2.54	7.35

* Not received.

RAINFALL RETURN FROM JAN. TO MAR., 1914.—CONTD.

Stations.	FEBRUARY.		JAN. TO FEB.		MARCH.		JAN. TO MAR.	
	1914.	1913.	1914.	1913.	1914.	1913.	1914.	1913.
<i>San Fernando and Princes Town District.—(Cont'd.)</i>								
Princes Town—Hindustan estate ..	2.62	1.45	4.23	7.42	1.02	1.41	5.25	8.83
La Retraite estate ..	4.36	1.58	9.06	9.09	1.70	3.50	10.76	12.59
Malgretoute estate ..	1.94	0.83	3.49	6.18	1.04	1.81	4.53	7.99
Savana Grande—Friendship and Ben Lomond estates ..	1.64	0.46	2.99	6.39	0.89	1.69	3.88	8.08
Poole—El Rosario estate ..	3.79	2.60	5.58	13.62	1.53	4.46	7.11	18.08
<i>Montserrat District.</i>								
Montserrat Constabulary Station ..	1.55	0.61	2.94	9.00	0.46	0.97	3.40	9.97
Brasso—La Vega estate ..	2.69	1.10	5.55	8.91	0.32	2.42	5.87	11.33
<i>Arima District.</i>								
Arima—Warden's Office ..	2.33	0.27	4.21	2.61	0.18	0.51	4.39	3.12
„ Torrecilla estate ..	3.89	1.20	6.21	5.76	1.20	2.86	7.41	8.62
„ Verdant Vale estate ..	2.44	1.46	4.13	6.14	1.61	3.65	5.74	9.79
San Rafael—Constabulary Station ..	5.05	1.13	6.97	8.90	1.23	4.11	8.25	13.01
Guanapo—Talparo estate ..	3.35	1.71	5.12	8.24	6.85	3.87	5.97	12.11
Tamana—Sta. Marta estate ..	3.55	2.83	6.34	10.61	2.35	5.09	8.69	15.10
<i>South-west District.</i>								
Oropuche—Constabulary Station ..	1.89	0.65	2.74	5.87	1.57	1.89	4.31	7.76
„ Pluck estate ..	2.09	0.39	2.43	5.36	0.87	1.04	3.30	6.40
Siparia—Constabulary Station ..	4.80	0.78	6.95	7.74	1.94	2.33	8.89	10.07
Guapo—Adventure estate ..	0.80	0.68	1.55	5.77	1.72	1.65	3.27	7.42
Cap-de-Ville—Constabulary Station ..	1.10	1.93	2.79	8.28	2.82	2.96	5.61	11.24
Erin—La Ressource estate ..	1.04	1.51	3.27	6.15	1.07	1.66	4.34	7.81
„ Industry estate ..	1.31	...	4.17	...	1.70	...	5.87	...
Cedros—Constabulary Station ..	1.57	2.01	3.54	5.58	1.90	1.60	7.44	7.18
„ Perseverance estate ..	1.80	...	3.58	...	1.90	...	5.48	...
Acacos—Constance estate ..	0.69	2.20	1.93	8.00	0.65	1.47	2.58	9.47
Irois—Irois estate ..	2.64	1.95	4.81	7.12	2.01	3.06	6.82	10.18
<i>South Coast.</i>								
Moruga—Constabulary Station ..	1.95	0.97	3.43	8.24	1.66	3.67	5.09	11.91
<i>North Coast.</i>								
Blanchisseuse—Constabulary Station ..	3.08	2.78	4.66	13.78	0.37	3.86	5.03	17.59
Grande Rivière—Mon Plaisir estate ..	4.55	3.25	7.15	17.26	2.30	5.66	9.45	22.92
Toco—Aragua House ..	2.91	1.72	5.14	13.92	1.06	2.81	6.20	16.73
„ —Constabulary Station ..	3.42	1.60	5.16	13.95	1.19	2.73	6.35	16.68
Point Galera—Light House ..	1.84	0.30	2.43	7.41	0.43	0.50	2.91	7.91
<i>East Coast.</i>								
Matura—La Juanita estate ..	2.62	2.04	4.82	12.75	1.73	5.56	6.55	18.31
Manzanilla—Constabulary Station ..	2.27	2.60	5.09	13.01	1.60	4.96	6.69	17.97
Sangre Grande—Sta. Estrella estate ..	3.07	3.99	7.29	13.45	3.24	5.43	10.53	18.88
„ New Lands estate ..	2.58	2.32	6.13	15.22	1.66	5.33	7.79	20.56
„ Evasdale estate ..	4.12	2.55	7.24	10.29	2.34	5.78	9.58	16.07
„ Grosvenor estate ..	3.56	2.76	6.11	11.33	1.99	5.16	8.10	16.49
Mayaro—Constabulary Station ..	1.49	1.05	3.21	12.44	1.17	2.13	4.38	14.57
<i>Tobago.</i>								
Tobago—Hermitage estate ..	3.02	2.90	6.31	12.73	2.37	3.17	8.68	15.90
„ Riversdale ..	...	2.12	...	8.75	1.06	1.71	4.30	10.46
„ King's Bay ..	3.14	2.12	6.60	11.64	1.94	2.32	8.54	13.96
„ Roxburgh ..	3.80	3.06	7.29	14.51	3.32	3.14	10.61	17.65
„ Lure estate ..	3.16	2.65	7.71	12.40	2.79	2.82	10.50	15.22
„ Botanic Station ..	1.26	1.13	3.54	6.20	1.24	0.93	4.78	7.13
„ Government Farm ..	0.53	0.63	1.51	3.62	0.79	0.72	2.30	4.34
„ Lowlands estate ..	1.76	0.78	2.74	5.00	0.47	1.39	3.21	6.39
„ Friendship estate ..	2.56	0.96	4.02	5.97	*	1.54	*	7.51

BULLETIN

OF THE
DEPARTMENT OF AGRICULTURE
Trinidad and Tobago.

VOL. XIII.]

MAY, 1914.

[No. 80.

SUGAR.

SUGAR CANE NURSERY.

EARLY in 1913 a Sugar Cane Nursery was established at River Estate, the outcome of proposals made by the Agricultural Society and carried into effect by means of money voted for the purpose by the Board of Agriculture. A site at River Estate was selected and the work of establishing and maintaining the nursery is carried on by the Department of Agriculture under the immediate care of Mr. J. de Verteuil the Superintendent of Field Experiments. The nursery has been chiefly stocked with new Barbados seedlings, purchased from the Agricultural Department of that Colony to the head of which, Mr. J. R. Bovell, I.S.O., F.L.S., our thanks for assistance are due.

The area first put under cultivation was approximately 3 acres, planted in April, 1913 with the following varieties :--

B. 1753	B. 6308	B. 7169
B. 3390	B. 6388	B. 16536
B. 4578	B. 6450	B. 16832
B. 4934	B. 6835	Bourbon.

The Bourbon canes were obtained from Palmiste and Felicite estates Trinidad.

At first the canes made little growth owing to the dryness of the weather but with the advent of the rains, in June and July, the plants progressed satisfactorily.

In December it was suggested that plants be offered for sale to the estate proprietors and the members of the Sugar Cane Committee of the Board of Agriculture were asked to inspect the nursery before distribution. Not being favourably impressed with the general appearance of the canes and owing to the large proportion of canes attacked by the small moth borer (*Diatraea lineolata*), the members present were of opinion that plants should not then be distributed but that the canes should be allowed to stand over until after the dry season.

Meanwhile, the Entomologist of the Board of Agriculture, was asked to inspect and report on the freedom or otherwise of the canes from insect pests. A copy of his report is attached.

Shortly after the Entomologist's visit all the Bourbon canes were completely cut out, and the canes of the other varieties which had been attacked by the small moth borer were also cut out and removed from the field. Trap lights have been used with a fair amount of success.

The canes have, generally speaking, grown well and the juice will be tested in May when the canes will be about 13 months old.

In December 1918 the nursery was extended--about one and a half acres being planted with selected plants obtained from the original nursery. The dry weather experienced during January, February and March has been a drawback to the young plants, only 2.72 inches of rain (of which 70 parts were recorded on March 31) having been registered, during this period, at River Estate.

ENTOMOLOGIST'S REPORT.

I visited River Estate Nursery with Mr. de Verteuil on January 18 and found that the principal pest there was the small moth borer *Diatraea lineolata* which had spoilt all the Bourbon canes as far as propagation was concerned, otherwise I did not notice any pests there that were more in evidence than on any sugar estate of other districts. I am afraid that *Diatraea* will always give trouble at Diego Martin. The following are some of the most important insects observed :—

INSECTS AND MILLEPEDES.

Diatraea lineolata and *Diatraea canella*. The first species was more numerous than the second. The Bourbons from Felicite and Palmiste were badly infested. B 1758, B 4578, B 6835, B 6450, B 6808, B 6888 and B 4984 only showed borer attack here and there and were not seriously affected.

Pseudococcus calceolariae. Mealy bug. Occurred on all the canes but not in sufficient numbers to be injurious. Two species of predaceous *Coccinellids* were found devouring the bugs. Mealy bugs are more injurious to young plants especially if many ants are present to foster them.

Metamastus hemipterus. Small weevil borer. Found only on a damaged cane of one stool. As a rule these beetles only attack fermenting canes and will not touch perfectly healthy plants.

Tomaspis varia. Froghopper. One solitary nymph was found on a cane root.

Oliarus sp. This small leafhopper was found in most fields and may be responsible for the yellow spots observed on some of the leaves; the leafhoppers were, however, not numerous and what appeared to be their eggs were parasitised by a Trichogrammid.

Colaspis lebasii. A small metallic green beetle was observed on the cane leaves, but as far as I know it does not attack canes, but lives on *Convolvulus* plants, of which plenty were growing near by. It had simply taken refuge among the canes.

Homophoea aequinoctialis. A small beetle with red prothorax and black elytra bearing eight white spots. Numerous in some fields, but with same habits as No. 6.

Besides above there were several small beetles and hemiptera found together with the mealy bugs either as scavengers or predators, but not affecting the canes. A few earwings were found but they do not attack canes.

Millepedes. A small species was found in the damp cane trash, but as far as I know it does not attack the cane, but lives on decaying vegetable matter.

FUNGI.

As far as I could see there was no root disease. Some of the leaves showed leaf spot.

(Sgd.) F. W. URICH.

C A C A O.

TRINIDAD CACAO IN FOREIGN MARKETS.

Appointment of a Commission of Enquiry.

At the meeting of the Legislative Council of April 22, the Hon. Carl de Verteuil moved the following resolution :—

That in view of the depreciation of Trinidad cacao in the foreign markets, due to causes which are preventible, it is advisable that the Government should take immediate steps to remedy the evil either by a system of inspection of all cacao exported, or by such other means as may be considered expedient, and that the necessary legislation should be introduced.

A discussion on the question followed at the close of which the Hon. S. W. Knaggs, Deputy-Governor stated that the whole question would be referred to a representative Committee.

Previous to the meeting of the Council a report was furnished to the Government at the request of the Deputy-Governor. This report which has since been published as *Council Paper* No. 70 of 1914 is given below. It affords a brief summary of previous action which has been taken in connection with this question. The report of the Cacao Claying Committee of the Board of Agriculture appeared in this *Bulletin* XII. 1913 p. 162 and the notice about excessive claying in which it resulted in Volume XIII. 1914 pp. 39-40.

REPORT ON THE QUESTION OF THE DEPRECIATION OF TRINIDAD CACAO IN FOREIGN MARKETS.

THE HON'BLE THE COLONIAL SECRETARY.

The question of establishing official Standards for cacao was under consideration in 1910 (*See C.S.M.P.* 5241/1910) as the result of a letter received from the Lowney Co. of the United States of America and Canada. At this time there was no suggestion of remedying depreciation of the Colony's cacao in foreign markets; the objects aimed at were "to relieve shippers of unfair arbitration" and to "place Trinidad cacao which is already highly esteemed by the manufacturers on a still higher plane."

This proposal was considered by the Board of Agriculture and a Government Committee finally appointed consisting of:

Director of Agriculture (Government member).

Hon'ble C. de Verteuil (Board of Agriculture).

L. J. Bernstein (Agricultural Society).

J. H. Smith (Chamber of Commerce).

The first two members reported recommending the formation of standards; the other two were opposed to the suggestion. On the reports being submitted to the Chamber of Commerce and Agricultural Society both these bodies approved of the one *not* advocating standardization. The Board of Agriculture has not as yet expressed any definite opinion.

More recently the establishment of a Government Standard was proposed as a means of preventing excessive claying (*See C.S.M.P.* 7647/1913), the Hon'ble Carl de Verteuil having brought to notice a letter

from a New York firm stating that Trinidad cacao was being sent with excessive quantities of clay and siftings and that unless this was prevented the market would be closed.

A Committee of the Board of Agriculture was appointed and recommended "that a standard be fixed for cacao; that not more than 2 per cent. clay be allowed." The Board adopted this report on October 17, 1918, with the proviso that before taking action it be considered by the Chamber of Commerce, Agricultural Society, and Cacao Planters' Association.

The Cacao Planters' Association reported that it was not necessary to fix a standard. The Agricultural Society and Chamber of Commerce held a joint Committee meeting and recommended the issuing of a warning first. This proposal was adopted by the Board of Agriculture and a warning, approved by and signed on behalf of those four bodies, issued and posted throughout the Colony, published in the press, Bulletin of the Department of Agriculture, &c.

It is apparent from the above that a very considerable diversity of opinion exists in the Colony as to the advisability of establishing official standards. The situation would be clearer if one had definite evidence that the majority or at any rate a good proportion of the planters wanted standards and that the merchants did not; so far, however, I have not found this to be the case. I am not qualified, however, to express any definite opinion, not having the necessary acquaintance with the inner workings of the cacao export trade. The Hon'ble Carl de Verteuil has this, and regards standardisation as desirable; apparently it is necessary yet to convert others to this view, and doubtless in moving his resolution he will bring forward reasons for the proposal.

There is another matter on which evidence is required and that is as to the extent and degree of the alleged depreciation. I have heard the view expressed that the complaints are not wide spread, and that they come only from a few sources.

The ordinary market quotations do not indicate any general depreciation in Trinidad cacao in either London or New York, as seen in the following table in which the comparative values of Trinidad and some other cacaos are practically the same in January 1914 as in January 1904.

LONDON.			NEW YORK.		
Shillings per cwt.			Cents per lb.		
Year.	Trinidad.	Grenada.	Trinidad.	Grenada.	Caracas.
January, 1904	64/- to 72/-	53/- to 62/-	13½-14½	12½-13	13½-14½
„ 1905	55 - 63	52 - 55	12 - 13½	11 - 11½	12 - 13
„ 1906	52 - 60	46 - 52	11½-11½	10½-11	12 - 12½
„ 1913	69 - 80	61 - 68	14½-15	14 - 14½	13½-15½
„ 1914	64 - 71	58 - 62	13½-13½	13 - 13½	13½-14½

Such a return is of course not conclusive evidence and Mr. de Verteuil will probably produce proof of the depreciation which calls for the adoption of standards and resulting inspection and branding.

In view of the existing diversity of opinion and the other matters to which I have referred, the Government would require to go into the whole matter carefully, possibly by forming a Committee (1) to consider the desirability of establishing standards, (2) to determine the standards if considered necessary, (3) to frame a scheme for inspection and marking. Such a Committee should be larger than the old "Standards Committee" and should I think contain representative planters and merchants in about equal proportions.

W. G. FREEMAN,

Acting Director of Agriculture.

April 20, 1914.

DESPATCH FROM THE BRITISH AMBASSADOR AT WASHINGTON.

Subsequent to the discussion in the Legislative Council His Excellency the Governor received the following despatch from His Excellency the British Ambassador at Washington covering a letter from the United States Department of Agriculture in regard to the alleged adulteration of cacao exported from Trinidad. This was laid before the Council on May 6 and has been published as *Council Paper* No. 79 of 1914:—

BRITISH EMBASSY, WASHINGTON,

April 17, 1914.

SIR,

I have the honour to enclose copy of a Note which I have received from the United States Secretary of State covering a letter from the Department of Agriculture in regard to the alleged adulteration of cacao beans imported from Trinidad. Secretary of State, April 13, 1914.
Enclosure.

I should be much obliged if Your Excellency would be good enough to inform me of the reply which you would wish me to return to this communication.

I have the honour to be, Sir,

Your Excellency's most obdt., humble Servt.,

(Sgd.) CECIL SPRING RICE.

His Excellency

The Governor of Trinidad, &c., &c., &c.,
Trinidad.

No. 308.

DEPARTMENT OF STATE, WASHINGTON,

April 13, 1914.

EXCELLENCY,

I have the honour to call your attention to the enclosed copy of a letter from the Acting Secretary of Agriculture, dated April 6, 1914, relative to complaints concerning cacao beans imported from Trinidad, it being claimed that these beans are adulterated with a heavy coating of clay or similar material which present-day machinery is not capable of removing. A coating which either conceals damage or inferiority or adds unduly to the weight is regarded as an adulteration under the Food and

Drugs Act. You will note that the Acting Secretary of Agriculture requests that you be advised of the position of the Department of Agriculture with a view to secure your co-operation that this practice may be discontinued.

In this connection, I may state that the American Consul at Trinidad, in a recent despatch, reports that merchants, agricultural societies, exporters and others have of late begun to realise that serious abuses have entered into the practice of claying, and that they have united in their efforts to prevent the continuance of such abuses. Claying, however, on a moderate scale is regarded by them as a preservative, and is generally practised. The Consul adds that the remedy rests with the importers, who may bring about the discontinuance of claying by offering for the clayed product a smaller sum than for the washed product.

Information received by the Department of Agriculture shows that beans coated in this way are difficult to handle in the factory, because the clay increases the weight of the shell, which must be removed by a winnowing process. It was the opinion of the informant that the coating was used to give added weight, and consequently the beans would be regarded as adulterated.

The Department sincerely requests your co-operation in this connection to the end that this practice may be abolished.

Accept, Excellency, &c., &c.,

For the Secretary of State,

(Sgd.) ROBERT LANSING.

His Excellency

Sir CECIL ARTHUR SPRING RICE,

Ambassador of Great Britain.

DEPARTMENT OF AGRICULTURE, WASHINGTON,

April 6, 1914.

THE HON'BLE THE SECRETARY OF STATE,

SIR,

This Department has received complaints concerning cacao beans imported from Trinidad, it being claimed that these beans are adulterated with a heavy coating of clay or similar material which present-day machinery is not capable of removing. A coating which either conceals damage or inferiority or adds unduly to the weight is regarded as an adulteration under the Food and Drugs Act. It is requested that the British Ambassador be advised of the position of this Department with a view to securing his co-operation that this practice may be discontinued.

Respectfully,

(Sgd.) B. T. GALLOWAY,
Acting Secretary.

APPOINTMENT OF A COMMISSION OF ENQUIRY.

As the outcome of the various representations and in order to ensure full investigation of this important question the following Commission has been issued by His Excellency the Governor :—

TRINIDAD AND TOBAGO.



By His Excellency Sir GEORGE RUTHVEN LE HUNTE,
Knight Grand Cross of the Most Distinguished
Order of St. Michael and St. George, Governor
and Commander-in-Chief in and over the Colony
of Trinidad and Tobago and its Dependencies
&c., &c., &c.

[L.S.]

GEORGE R. LE HUNTE,
Governor.

TO THE HONOURABLE HENRY COWPER GOLLAN, K.C.;
THE HONOURABLE ARCHIBALD GRAEME BELL,
C.M.G., M. Inst. C.E.; THE HONOURABLE HENRY
BARCLAY WALCOTT, C.M.G.; THE HONOURABLE
HENRY ALBERT ALCAZAR, K.C.; THE HONOURABLE
CARL DE VERTEUIL, JOHN BAPTISTE
DENIS SELLIER, Esquire; ALBERT HENRY
CIPRIANI, Esquire; and WILLIAM GEORGE
FREEMAN, Esquire, B. Sc., A.R.C.S., F.L.S.]

GREETING :

WHEREAS by Section 2 of the Commissions of Enquiry Ordinance No. 119 it is provided that it shall be lawful for the Governor, whenever he shall deem it advisable, to issue a Commission appointing one or more Commissioners and authorising such Commissioners or any quorum of them therein mentioned to enquire into the conduct of any officer in the Public Service in this Colony, the conduct or management of any Department of the Public Service or of any Public or Local Institutions, or into any matter in which any enquiry would, in the opinion of the Governor, be for the public welfare ;

And whereas in my opinion it would be for the public welfare that an enquiry should be held into the causes of the depreciation of Trinidad Cacao in the Foreign markets.

Now, therefore, I, GEORGE RUTHVEN LE HUNTE, Governor of the said Colony, do hereby in pursuance of the powers vested in me in this behalf by the Commissions of Enquiry Ordinance, No. 119, issue this my Commission to you the said HENRY COWPER GOLLAN, ARCHIBALD GRAEME BELL, HENRY BARCLAY WALCOTT, HENRY ALBERT ALCAZAR, CARL DE VERTEUIL, JOHN BAPTISTE DENIS SELLIER, ALBERT HENRY CIPRIANI and WILLIAM GEORGE FREEMAN, appointing you to be Commissioners to hold the enquiry aforesaid ; and I do hereby direct that the said enquiry shall be held in public ;

And I direct that you, HENRY COWPER GOLLAN, shall be Chairman of the said Commissioners, and further that any five members of the Commission shall form a quorum;

And I direct you the said Commissioners forthwith to proceed at such places and times as may be convenient to you with due diligence to enquire into the matter aforesaid, and to report to me in writing under your hands upon the said matter, and to give your opinion and recommendation thereon in one or more Reports, and to furnish me with such account of your proceedings and such reasons for your conclusions as I may require.

And this my Commission shall continue subject to any alteration or revocation thereof until you shall have finally reported.

Given under my hand and the Public Seal of the Colony, at Government House, in the town of Port-of-Spain, this 14th day of May, 1914.

By His Excellency's Command,

S. W. KNAGGS,
Colonial Secretary.

CACAO NOTES FROM OTHER COUNTRIES.

SIERRA LEONE.

A beginning has been made with cacao cultivation in Sierra Leone. In the recently received *Annual Report* on the Department of Agriculture of that Colony for 1912, Mr. D. W. Scotland, the Acting Director of Agriculture reports that on a visit to the Gallina tribe he found that "this enterprising race had on its own initiative" started 29 cacao plantations, the sizes of which vary; the largest containing apparently about 8,000 plants. One owner had harvested his first crop—190 lb.—which realised three pounds. Mr. Scotland remarks that most were planted too closely—some being only six feet apart—and that the young plants were insufficiently shaded. In Sierra Leone with its prolonged dry period of five months he regards shade as essential.

Sierra Leone has been adversely reported on a cacao country because of the long drought from December to May. "It is true" Mr. Scotland states "that hardly any rain falls during that period but during December to January and a good part of February there are heavy dews every night and the humidity of the atmosphere is fairly high. The high humidity of the atmosphere saves too rapid evaporation of moisture from the plant and consequently the plant does not demand a high percentage of water in the soil."

There are now Government cacao plantations in various localities and the development of cacao cultivation in Sierra Leone will be watched with interest.

Mr. Scotland it may be noted was one of the officers from West Africa who recently visited this Colony to study agricultural conditions. (See *Bulletin* xiii, 1914, p. 86.)

SOUTHERN NIGERIA.

The *Annual Colonial Report* on Southern Nigeria for 1912 states "From the figures given below it will be seen that, although the exports of cacao were lower than those of the year 1911, they are considerably above those of the preceding three years. The falling off in the cacao crop was due to abnormally small rainfall.

Year.		lb.		Value.
1908	...	3,060,609	...	£ 50,587
1909	...	5,019,150	...	71,916
1910	...	6,567,181	...	101,150
1911	...	9,858,774	...	164,664
1912	...	7,953,711	...	130,542
Total for 5 years	...	32,459,425	...	518,859
Average for 5 years	...	6,491,885	...	103,772

39,675 cacao plants and over 12,000 cacao seeds were distributed by the Department of Agriculture."

BRAZIL.

According to the *Journal of the Board of Trade*, April 2, 1914, "H. M. Legation at Rio de Janeiro reports that the exports of cacao from Brazil during the last two years have remained stationary, although both consumption and prices are increasing. Brazilian cacao-growers have not improved the methods of preparing the product for the market, and cannot command as good prices as are obtained for the San Thomé product. There seems no reason why the cacao industry in Brazil should not have a splendid future, as there is abundance of suitable soil, and cacao requires comparatively little labour and capital. It can be grown with success in the Amazon Valley, where it may possibly replace rubber to a certain extent."

BIRDS.

BIRDS AND THEIR VALUE TO THE AGRICULTURIST

With Some Notes Concerning Insects.

By P. L. GUPPY.

Continued from page 128.

NESTING-PLACES OF WOODPECKERS.

Mr. Broadway has found out that the Tobago Carpenter Bird (*Centurus terricolor*)* will nest in a bamboo pole. This important observation was made at the Botanic Station, Tobago. The pole is attached to a cashew tree and does duty as a flagstaff,—it is about twenty feet high. The hole which the bird went into was high up and evidently made by this Carpenter bird for the purpose of nesting in.

Mr. Carr informs me that some woodpeckers in Trinidad nest in holes in dead Bois immortel branches.

Mr. G. Humphrey Sworder of Tobago, has found nests in wooden telephone poles, dead coconut stumps, and in dead stumps of forest trees after high woods are cleared, if the latter are high enough, also in dead limbs of big immortel trees.

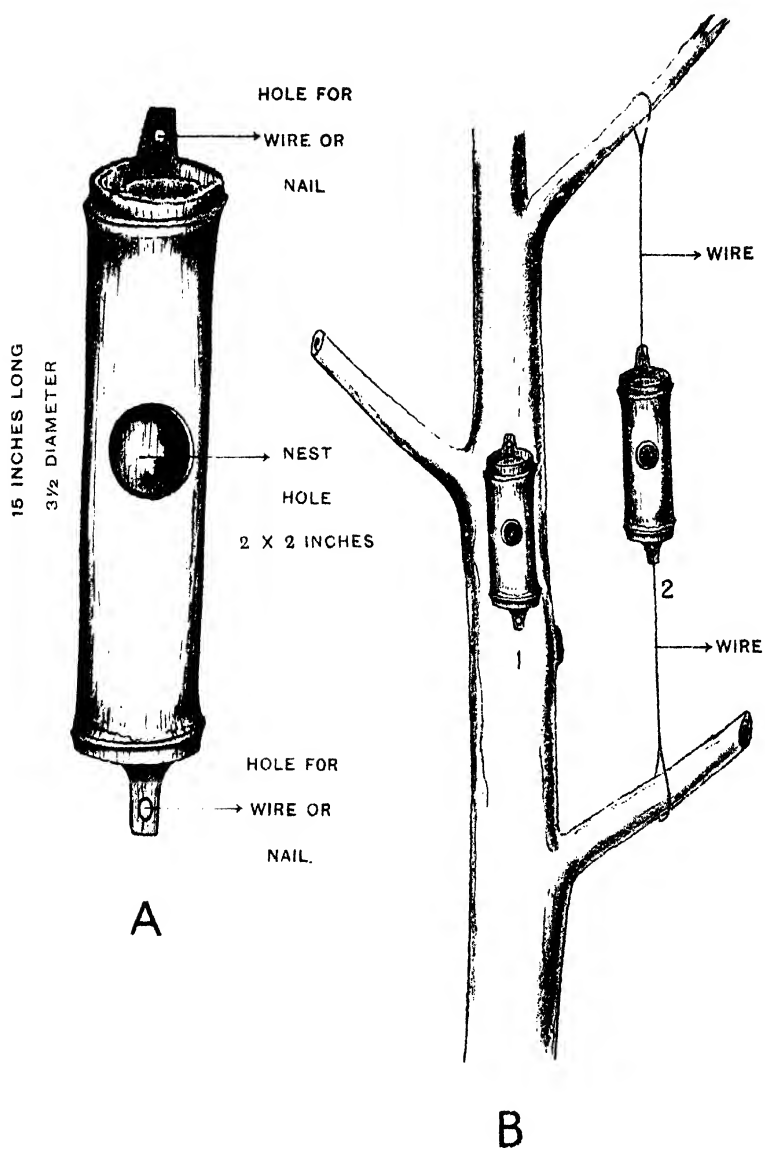
In bird-reserves and cacao-groves bamboo-joint nesting-places might be tried to encourage useful † woodpeckers.

BAMBOO-JOINT NESTING-PLACE.

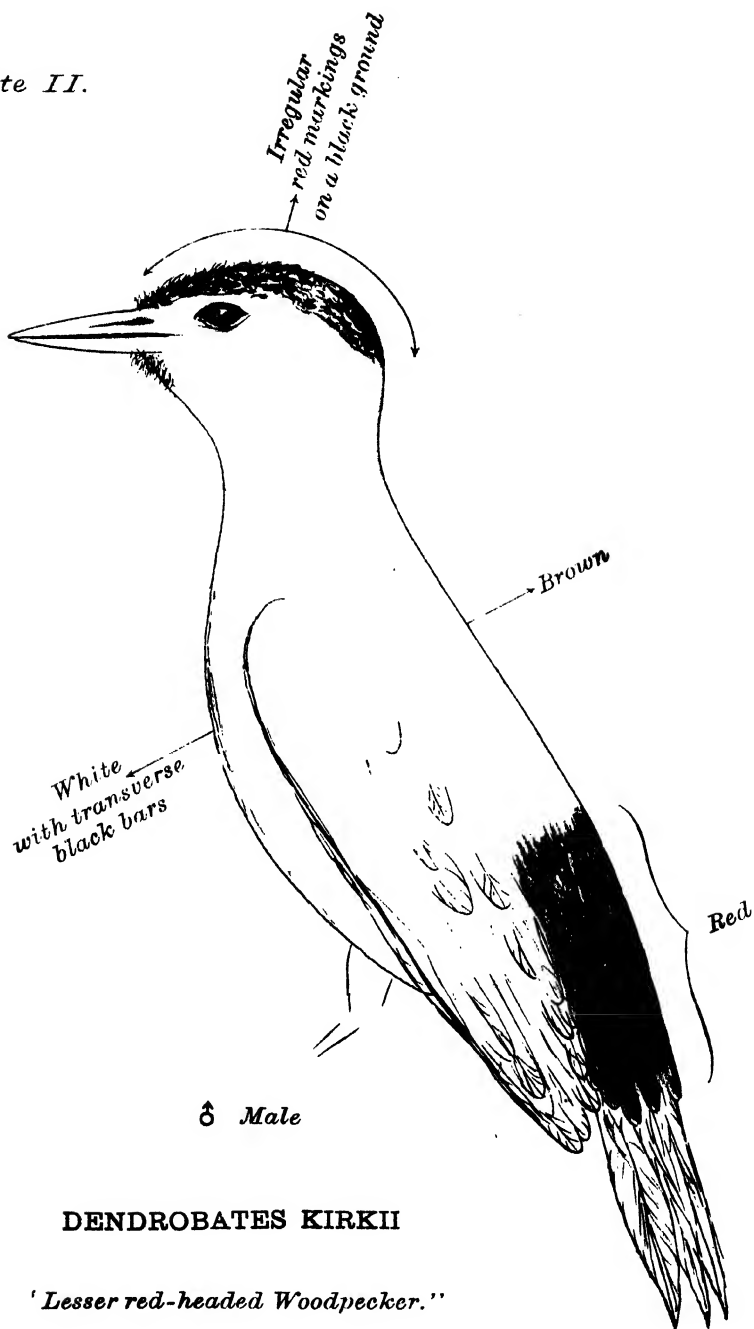
Joints from 12 to 15 inches long are recommended,—holes should not be more than 2 × 2 inches as suggested by Mr. Carr. Bamboo joints may be either nailed against trunk of tree as at B. 1, or suspended by wire as at B. 2. The height from ground should be about 20 feet.

* *Terricolor* as originally published appears a misprint for *tricolor*. Another name for this bird is *Melanerpes tricolor*.

† It is possible that other birds might adopt this kind of nesting-place.



BAMBOO-JOINT NESTING PLACE.



DENDROBATES KIRKII

'Lesser red-headed Woodpecker.'

(Trinidad and Tobago.)

Red on rump covered by wings usually.

Female has no red on head, only pale yellow ring.

USEFUL AND HARMFUL WOODPECKERS.

The following note on the three species of woodpeckers referred to in Part I of this paper (pp. 120 and 128) will be of service in assisting planters to distinguish the useful from the harmful birds.

These rough sketches are mainly intended to point out the markings on the heads of the best known species, about which there appears to be so much confusion:

Broadly speaking these birds have a somewhat similar colouration scheme, being more or less "speckled," like a guinea-bird, or the well known "ant thrush" or "pintade."

THE LESSER RED HEADED WOODPECKER.

This bird is included in the list of useful birds Table I (p. 119), and is described by *Fielden as follows:—"Length 7·5 inches, wing 3·5 inches.

On the head irregular red markings on a black ground, rump red. Throat white slightly speckled with black; bill, legs and iris black.

The female has a pale yellow ring round the occiput but no red on the head."

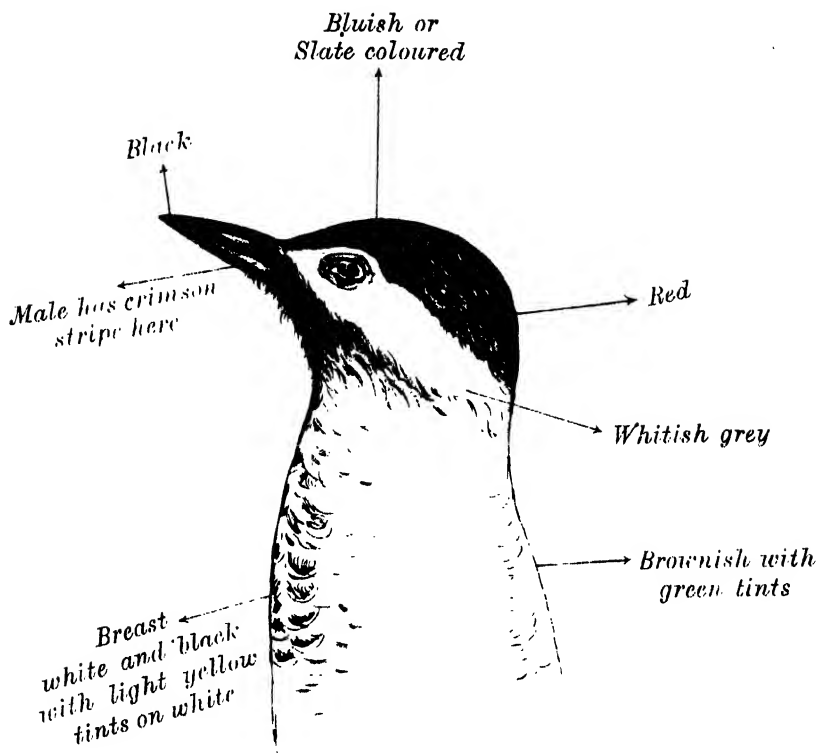
BLUE HEADED WOODPECKER.

Male with crimson stripe along line of lower mandible (=malar stripe).

* Described by Fielden as follows:—"Blue headed woodpecker Length 7.5 inches, wing from joint, 4.25 inches.

Forehead and crown blue, occiput and neck red. Throat white striped with black, upper parts dull brown, under parts white, with transverse black bars; malar stripe red, legs brown, bill and iris black. The female has no malar stripe."

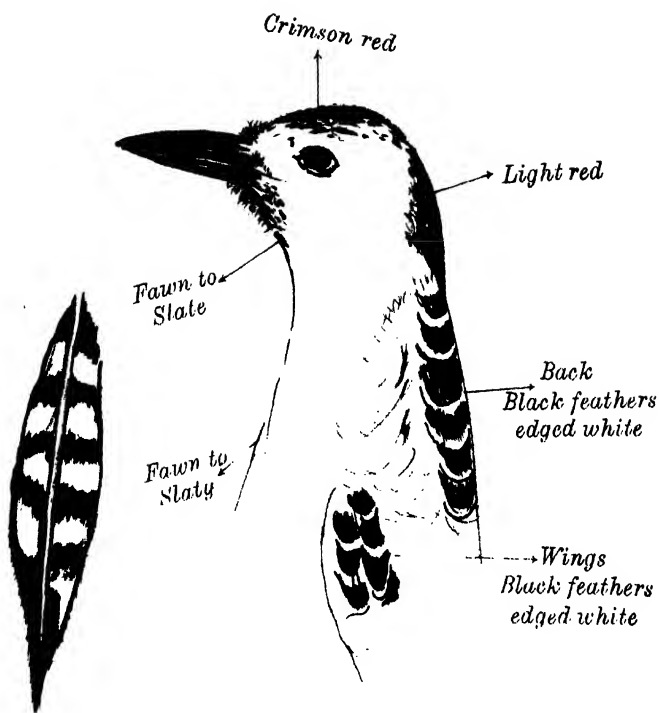
See Table III. (p. 123). "Birds frequenting cacao groves.—*Harmful*"



"Blue-headed Woodpecker." ♀ (female.)

CHLORONERPES RUBIGINOSUS, Swains.

(Trinidad and Tobago.)



*Tail feather.—nat. colour
(slightly enlarged)*

♂ (Male)

CENTURUS TRICOLOR
MELANERPES TRICOLOR

'Little red-headed Woodpecker.'

Tobago only

LITTLE RED HEADED WOODPECKER.

Female has not got the crimson crown, only light red at nape of neck.

Fielden does not appear to have described this bird. This species only occurs in Tobago. Length about $7\frac{1}{2}$ inches, wing $4\frac{1}{2}$ inches. Crown crimson red. Nape of neck light red. Throat and under parts fawn to slaty—upper parts and wings black with transverse white bars.

This bird is a well-known pest in Tobago, but does not occur in Trinidad.

See Table III, (p. 123) where it is described (2) and (3) under the two names now regarded as synonyms.

(PART II).—GENERAL NOTES ON BIRD-LIFE.

The following observations on bird-life in general are mainly taken from notes contained in correspondence between Mr. Klages and myself.

Leotaud records the total number of the birds of Trinidad to be about 800 species, of these there are quite a number common in Venezuela but never obtained by any naturalist visiting Trinidad.

It is a question whether Leotaud has not in his anxiety to increase his collection, allowed himself to be imposed upon by persons offering skins from Venezuela as Trinidad specimens.

Of *land-birds* alone Trinidad probably does not possess more than 190 species. Migratory and aquatic birds supply the balance.

Mr. Klages and myself share the opinion that there is far too much popularly-believed "folk-lore" in vogue in regard to the utility of birds. Of course these ideas exist in most countries until proper investigation puts the question on a trustworthy basis.

With a few notable exceptions, mentioned in Part I of this paper, birds really play a very little part in keeping down insect-pests in Trinidad.

As examples I may quote some well-known insect-pests which are often abundant at various seasons, and which play havoc in localities where birds are plentiful.

- (1.) The "cotton-stainer" (*Dysdercus howardi*),
- (2.) The "corn-bud-worm" (*Laphygma frugiperda*),
- (3.) The "tobacco horn-worm" (*Protoparce sexta*),
- (4.) The "tobacco bud-worm" (*Chloridea virescens*),
- (5.) Cutworms (*Prodenia* spp.),
- (6.) "Striped cane-looper" (*Renigia repanda*),
- (7.) The sugar-cane budworm (*Cirphis humidicola*),
- (8.) Froghoppers (*Tomaspis* spp.) and numerous others.

Were it not for egg parasites, and other insect-enemies of insect-pests there would be nothing green left on the surface of the land.

Birds feed far too indiscriminately and as mentioned in earlier part of this paper they prefer, like the "Qu'est-ce-qu'il-dits," to gain a living with as little trouble as possible around human habitations, away from the cacao and sugar-cane fields.

There can be no doubt whatever that in the popular mind, the mere fact of a bird eating insects is sufficient to create an impression that that bird must be useful. It is equally certain that none but an economic zoologist is in a position to form even an approximate estimate of the real value of the services rendered to mankind by birds. For instance the uninformed planter may exclaim with satisfaction over the capture of a dragon-fly (*Odonata*) by a bird, whereas the entomologist who knows the

life-history of the victim would be affected in a reverse manner by speculating as to whether the destruction of all the enemies of the dragon-fly (*Odonata*) might not be the solution of the problem of the elimination of malarial fevers from tropical countries.

Are we aware of the great number of beneficial insects that form the bulk of the diet of some of these birds that feed indiscriminately? The whole question is of great complexity.

A fairly prevalent opinion is that the injurious carpenter-birds perforate pods in order to provide an attraction for insects upon which they plan to feed later. In perforated pods examined, no noxious insects have been found, only such as feed on decaying vegetable matter,—viz.:—ear-wigs, "rove" beetles (*Staphilinidae*) and other small Coleoptera (beetles), and cockroaches. Whether the carpenter birds eat these small insects in the pods, or not, does not matter,—there is no room for doubt that they bore holes in the pods, and so cause loss to the planter.

The majority of birds should be protected for aesthetic reasons alone; they are beautiful and interesting; but we must look the matter squarely in the face and deal drastically with those birds that are pests and those that become so from time to time. The harmful species are comparatively few in number, but none the less they cause loss to the planter especially when allowed to increase unduly.

BIRDS INJURIOUS TO RICE-FIELDS.

1. The grass birds generally.
2. Doves, especially the small reddish-brown species.
3. Grackles, namely, the little black corn-bird (*Molothrus atronitens*) and the soldier bird (*Liestes militaris*, Linn.)

None of these birds are in any conceivable way useful. The "grass-birds" and doves are exclusively granivorous and frugivorous. The two "grackles" mentioned seldom if ever eat any insects, the entire family being chiefly frugivorous.

BIRDS INJURIOUS TO FRUIT GROWING INDUSTRIES.

1. Parrots and parakeets.
2. Tanagers, especially the common "blue-bird," the "palmiste," &c.
3. The large yellow-tailed grackle (*Ostinops decumanus*) and others of this family.

None of the above are insectivorous birds.

BIRDS INJURIOUS IN OTHER WAYS.

The "Honey-creepers" (*Coerebidae*) as is pretty generally known are accused of disseminating the bird-vine (*Loranthaceæ*). The common "blue-bird" (*Tanagra cana sclateri*) and some of the smaller Tanagers, Warblers, &c.:—have something to do with this.

The well-known rapidity with which a new clearing, in the midst of a forest will fill up with noxious weeds may be attributed to transportation of seed by birds,—except of course in the case of plants having the seeds enveloped in an adhesive burr,—these would be carried by man and animals passing from place to place.

The rapidity with which bird-vine spreads, and is spreading, calls for early action against the guilty birds,—they should be thinned down during the fruiting season of the parasite, this together with the progressive work now being done in having bird-vine cut out, should go a good way towards its gradual extermination from most districts.

A valuable little bird that frequents human habitations is the “wren” or “God-bird” (*Troglodytes rufulus*, Cab.)—it is very useful in gardens and orchards. Unfortunately it is pursued by a parasitic bird (the oat bird) which is much larger than itself, and prevents the “wren” from being as plentiful as it might be. The popular names of some of the birds accused, (and in some cases it seems rightly so) of disseminating bird-vine, are “Acravat,” “Semp,” “Louis d’Or,” “Blue-bird.”

(PART III).—PARASITIC INSECTS.

It is mainly to beneficial insects, rather than bird-life, that we must count on for the balance of nature to be maintained.

In his *Manual of Injurious Insects*, Mr. Collinge has the following:—

“The subject of insect-enemies of insects is now one of the greatest importance.”

“In the United States of America it has received a large amount of attention, insectaries have been established, and many insects, particularly scale insects, held in check, or almost exterminated.

“The results that have been achieved in America are little short of marvellous, and read more like a fairy-tale than the sober facts of science. One by one the original homes of different insects have been run down, and their natural insect-enemies discovered.”

In some cases the latter have been transported long distances, by means of intermediate breeding stations and at considerable cost.

The introduction into any country of an insect which is a specific enemy of an insect-pest is never fraught with danger,—should the pest be destroyed its enemy would also succumb, or possibly it might attack a species closely allied to the pest if any occurred in the same country.

For example if an efficient egg-parasite of the * sugar-cane froghopper were introduced into Trinidad, and it proved to be so effective that the sugar-cane froghopper became very scarce, the parasite might in turn attack the eggs of the † black “froghopper” but this is as far as it could go.

Hymenopterous parasites, Tachina flies, and Syrphid flies play the ‡ most important part in controlling our insect-pests in Trinidad.

One of the most efficient and valuable Hymenopterous parasites we have here is *Anagrus flaveolus* on the eggs of the “corn-leafhopper” (*Peregrinus maidis*). It is marvellous the way in which this minute pink parasite shadows this pest of corn, destroying from 75 to 80 per cent. of its eggs.

The “cotton worm” (*Alabama argillacea*) so well-known throughout the West Indies is efficiently held in check here in Trinidad by Tachina

* *Tomaspis varia*, Fab., *Saccharina*, Dist.

† *Tomaspis pubescens*.

‡ Certain spiders (*Arachnidae*) are also very useful.

flies (*Phorocera* sp. near *Chrysocephala*, Walk.) Many other caterpillars are attacked by various species of these valuable flies. The Syrphid flies are active on Aphids, Coccids ("mealy bugs") and froghopper nymphs.

These are only a few examples of the value of beneficial insects, and to such as these we owe the fact that we are able to grow anything.

Most planters are fully aware of the extensive damage a pest can do when it gets out of hand. The appearance and disappearance of the froghopper at long intervals in various localities is mainly due to the presence or absence of natural enemies. Most insects lie dormant during dry seasons and the lengthy period during which the froghopper can aestivate in the egg-stage is the principal reason why it gets such a good start when the wet-season commences, most of its enemies have been starved out of existence, and before the latter can multiply and spread again much damage is done.

PARASITIC FUNGI.

A number of species of Entomophagous fungi act as checks to the spread of injurious insects, particularly the different species of *Cordyceps*, *Sporotrichum*, *Isaria*, *Empusa*, and *Entomophthora*.

Many planters know how effective the "green muscardine" can be under favourable conditions, there is also an *Empusa* which I have seen in Naparima attacking a very high percentage of froghoppers.

In some West India Islands scale insects have been effectively controlled by using fungi artificially spread.

The "green muscardine" has also been used to control beetle larvæ and has been found to attack Lepidopterous larvæ (*Diatraea* spp.) the small moth borers.

Mycologists in the West Indies will no doubt tell us that there is still a lot to be done in the line of investigating further problems for the practical application of artificially cultivated fungi.

CULTURAL METHODS. †

Writing some years ago of the "Hessian fly," Professor F. M. Webster stated "four-fifths of its injuries may be prevented by a better system of agriculture"—and whilst we cannot say this of the majority of insect pests, there is little, if any, doubt that better and cleaner cultural "methods would materially lessen the losses that result from injurious insects."

In regards to crop rotation "It may be laid down as an axiom that no two crops botanically allied should be planted in successive years on the same ground, or on closely adjoining ground."

It is a well-known fact that in certain countries unless a systematic scheme of rotation was the rule, the agriculturist could not grow a paying crop.

For the treatment of the soil there is nothing equal to a dressing of ground *unslaked* lime, applied before ploughing, at the rate of 12 to 15 cwt. per acre and turned under to a depth of 8 or 9 inches. On small

* *Metarrhizium anisopliae* (Metschnikoff).

† From a "Manual of Injurious Insects."

areas it should be dug in, not forked. Of course the quantity of lime to be used will depend on the nature of the soil, &c.:—the figures given apply to arts of England where those proportions have been found suitable.

CONCLUDING REMARKS.

It is well-nigh impossible to *exterminate*, any injurious insect, but means may be devised, after studying the life-history and other conditions surrounding an insect pest, effectually to keep it under control.

Periods of drought do not affect injurious insects adversely, on the contrary, most of them can rest, (aestivate) in one or other of their stages, during the longest dry-season. Not so, however, the beneficial species which depend on a continuous supply of their hosts to enable them to survive.

The object of most of the notes contained in Part III is to answer some of the many questions that Planters have often asked;—it has therefore been only necessary to put the information as briefly and clearly as possible and the writer hopes they will be of some help to those interested in the every-day work of the Entomologist or Economic biologist; both terms are used, but the latter is more descriptive.

LIVE STOCK.

COCONUT MEAL ANALYSIS.

Coconut meal, the residue left after expression of the coconut oil from the dried kernel of the nut (copra) is extensively used mixed with other materials as a feed for stock. Samples were analysed recently by Mr. A. E. Collens, Assistant Analyst, to determine their comparative values for use at the Government Farm, and the results are published for general information :—

PERCENTAGE COMPOSITION.

		I	II.	III.
Moisture	...	12·02	15·12	13·18
Oil	...	16·92	17·04	14·20
*Albuminoid Compounds	...	16·81	20·63	19·44
Mucilage, starch, etc.	...	23·33	36·71	32·10
Woody fibre	...	10·00	4·72	5·00
Ash	...	10·92	5·78	6·08
		100·00	100·00	100·00

* Containing nitrogen... 2·69 per cent. 3·30 per cent. 3·11 per cent.

Feeding units ...107·65 „ 130·88 „ 116·20 „

No. 1 is a mixed meal containing a large proportion of rice shudes and quite inferior to the others. No. 2 is the best meal of the three.

LIVE STOCK EXPORTED FROM TOBAGO 1911-14.

Stock.	1911-12.			1912-13.			1913-14.		
	Head or dozen.	No. shipped.	Value.	Head or dozen.	No. shipped.	Value.	Head or dozen.	No. shipped.	Value.
			£ s. d.			£ s. d.			£ s. d.
Cattle	... Head	523	3,138 0 0	Head	614	3,692 0 0	Head	552	3,312 0 0
Sheep	... „	383	306 8 0	„	519	415 4 0	„	673	538 8 0
Pigs	... „	1,857	1,392 15 0	„	1,867	1,399 5 0	„	1,798	1,348 10 0
Horses	... „	97	1,212 10 0	„	82	1,025 0 0	„	153	1,012 10 0
Mules	... „	12	240 0 0	„	34	680 0 0	„	24	480 0 0
Donkeys	... „	7	28 0 0	„	14	56 0 0	„	6	24 0 0
Goats	... „	1,941	368 4 0	„	1,810	362 0 0	„	2,256	451 4 0
Poultry	... Doz.	1,835	1,376 12 6	Doz.	2,112	1,584 7 6	Doz.	2,554	1,915 10 0
Eggs	... „	6,435	321 15 0	„	11,670	583 19 0	„	10,770	538 10 0
Total	... „	...	£8,384 4 6	...	...	£9,787 15 6	...	...	£ 10,520 12 0

H.M.

TREATMENT OF WARTS.

A question frequently asked is: "How to remove warts in the skin of horses and cattle?"

Some animals are more subject to warts than others. If the warts have a nick the best way to get rid of them is by tying a small, strong string tightly around the wart, as close to the skin as possible, using what is known as a doctor's knot or one of a kind that will not relax; leaving the string tied tight stops the blood circulating in the wart and causes it to die and drop off.

If the wart is flat and has no nick saturate it with an alkali such as washing soda. The alkali has the effect of opening up the leaves of which the warts are composed; a caustic agent can then be applied and will then go right into the substance of the growth and destroy it.

Probably the most efficient application is one composed of arsenic and soft soap, using as much of the former as will be absorbed by the latter to form a paste. This paste must be used with the greatest care, the surrounding skin must be greased and avoided or serious sores will occur. The paste is very useful for spreading warts.

Warts that are situated upon the eyelids, about the muzzle and in any other dangerous situation should be treated with a strong solution of salicylic acid.

H. M.

BOTANICAL.

INSTRUCTIONS FOR SENDING SMALL LIVING PLANTS BY POST.

Dr. Hans Goldschmidt to whom the Department is indebted for orchids sent to the Botanic Gardens in exchange has forwarded the following directions for sending small living plants by post. Samples of the bags, etc. referred to can be seen at St. Clair Experiment Station :—

The simplest and safest means of forwarding small living plants from tropical countries, is by post as "samples of no value." I have had go experience, especially with the packing of orchids of all kinds, including the very delicate terrestical orchids of the *Anoctochilus* group. The packing should be done as follows :

It is best to pack the orchids in sawdust which must be air-dry. At all events moisture on the packing material must be avoided. Coconut fibre or the brown fibrous earth found in the leaf axils of many tropical palms can also be used instead of sawdust. The earth must, of course, be broken up and sifted. Sphagnum especially has turned out very well as packing material. All these packing materials are not to be used in a wet condition; they have to be air-dry.

The small plants are well surrounded with this material, and then wrapped several times in gutta-percha tissue or oiled silk, so that it is practically impossible for them to come into contact with the air. This should be tied up with string or bast, so as to make a firm parcel, and then wrapped in one or two layers of parchment-paper. Several plants can often be put into one sample bag. Small orchids with bulbs can also be despatched in the same manner.

Plants with tender, fragile rootstocks and stems should be carefully and firmly tied to sticks before wrapping them up, so as to avoid breaking them when being packed. *The more carefully the packing is done, the more likely are the plants to arrive in good condition even after a journey of four to eight weeks.* It is also necessary to ascertain beforehand the conditions under which they can be posted, and the limit of weight; here as is well known, the sample when ready for despatch must not exceed 350 grammes (12 1/3 ounces) in weight, otherwise it will not be accepted by the post-office officials.

If circumstances permit, it is advisable to pack the small plants at once when taking them out of the ground, or very soon afterwards. This precaution is very essential when it is a question of thin-leaved orchids without bulbs, such as *Anoctochilus*, *Goodyera*, *Physurus*, etc. The weight should also be immediately ascertained by means of a light pair of scales, as excess weight can easily be avoided when packing. Should, however, the packing be only provisionally done and the packet afterwards have to be untied, tender plants are easily damaged.

AGRICULTURAL LEGISLATION.

AGRICULTURAL FIRES COMMITTEE.

Report.

The appointment of a Committee of the Board of Agriculture to consider any amendments necessary to the law regarding agricultural fires was reported in this *Bulletin*, XII, 1913, p. 156. The following is the report of the Committee as adopted by the Board of Agriculture on April 17, 1914:—

IN September, 1913, the Government, referred, for the advice of the Board of Agriculture, two special points arising out of a prosecution for setting fire to lands at Four Roads on which the views of all the Wardens had already been obtained (C. S. M. P. No. $\frac{1}{13}+\frac{1}{3}$) and also asked for suggestions as to any other amendments of the law which might be considered necessary.

At the meeting of the Board of September 19, the following Committee was appointed: Hon'ble R. S. A. Warner, Messrs. W. Greig, A. V. Stollmeyer, W. C. Jardine and W. G. Freeman.

Subsequently, the report of the Select Committee of the Agricultural Society (Society Paper 572) was referred to the same Committee, the personnel of which was also altered. The final Committee was constituted as follows: The Hon'ble R. S. A. Warner, Hon'ble W. G. Kay, Messrs. A. B. Carr, J. d'Abadie, W. C. Jardine and W. G. Freeman, together with Major A. S. Bowen, Warden of St. Ann's and Diego Martin and Mr. Thornton Warner, Warden of Tacarigua.

The Committee recommends that the Agricultural Fires Ordinance, No. 6 of 1910 be amended so as to give effect to the following proposals:—

1. That the definition of "Owner" be restricted to Owner proper, attorney or manager.
2. That licenses be granted to contractors, cane farmers, and tenants only on the written consent of the owner, attorney, or manager.
3. That contractors, cane farmers, and tenants be made subject to all liabilities and penalties under the Ordinance.
4. That the procedure for obtaining licenses now laid down in Section 4, necessitating two visits to the Warden's Office be done away with and that instead an applicant may be able to bring to the Warden's office, not less than 24 hours before fire is to be set, a proper certificate signed by one owner at least of land bounding with or in the immediate neighbourhood of the land in respect to which application to burn is made; the acceptance of such certificate to be in the discretion of the Warden, who if he does not regard it as satisfactory shall inspect or cause the land to be inspected.

The Committee is of opinion that Section 5 of Ordinance 170, with certain modifications, would give effect to these suggestions.

5. That a form of certificate be added as a schedule to the Ordinance and that on this the penalty for a false certificate be conspicuously printed.

6. That Section 8 be amended to give effect to the principles contained in the following recommendation of the Agricultural Society's Committee, subject to any alterations necessitated by other suggestions in this report :—

“ It shall be the duty of every owner whenever fire shall be set to
“ any land under a license granted to him under this Ordinance
“ or whenever any fire shall come on to his land or be found on
“ his land, to cause such land whether during the continuation
“ or after the expiration of his license or so long as any fire
“ licensed or not shall be thereon to be closely watched by some
“ responsible servant or agent to be by such owner appointed
“ for such purpose, and it shall be the duty of such owner to
“ use every endeavour by himself, his servants and agents to
“ extinguish any fire which may escape or extend from the land
“ on which any fire shall have been set by him into any neigh-
“ bouring lands, and to extinguish any fire that may have come
“ on his land or be found on his land without license.”

7. That Section 9 be amended to give effect to the principles contained in the following recommendation of the Agricultural Society's Committee, subject to the same proviso as in paragraph 6.

“ If any person shall set fire to any land, or shall aid in setting
“ such fire, or shall procure the setting of such fire without a
“ sufficient license in that behalf under this Ordinance, such a
“ person shall On conviction thereof before a Stipendiary
“ Justice of the Peace forfeit and pay a sum not exceeding
“ fifty pounds nor less than one pound, and if such fire shall
“ have been set by the owner or the setting thereof procured by
“ such owner after obtaining a license in that behalf under this
“ Ordinance without such notice having been served as herein-
“ before directed by Sections 6 and 7, such person or owner
“ shall on conviction thereof forfeit and pay a sum not exceed-
“ ing fifty pounds or not less than one pound.” but that the
penalties be as in Section 14, namely, not exceeding fifty
pounds nor less than five pounds or imprisonment with or
without hard labour for any term not exceeding six months.

8. That deputies to issue fire licenses may, with the approval of His Excellency the Governor, be appointed by Wardens. In large Wards there are many cases of hardship if the present law is strictly enforced and an applicant is refused a license owing to the absence of the Warden.

9. That to the liability (under Section 23) for damage done by fire there be added liability for the expenses incurred in extinguishing fires which through negligence have spread to other person's lands.

10. That special care should be exercised by Wardens in granting licenses in the neighbourhood of oil lands.

(Sgd.) W. G. FREEMAN,

March 20, 1914.

Chairman.

LAND REGULATIONS.**PART III.—ALIENATION.****RURAL LANDS.**

The following regulations were published in the *Royal Gazette*, April 9, 1914:—

TRINIDAD AND TOBAGO.

GEORGE R. LE HUNTE,

Governor,

Intendant of Crown Lands.

Clause 27 of the Land Regulations dated the 4th day of September, 1913, is hereby revoked and the following shall be read in lieu thereof:—

Petitions to purchase Rural Lands shall be made for parcels of not less than five or more than one hundred acres of such land, provided that in the case of Swamp Land petitions may be presented in respect of parcels of not less than two acres.

No petitioner will be permitted to petition for more than one parcel of land at a time, and no second petition from the same Petitioner shall be received until at least one half of the land already granted to the said Petitioner has been brought under cultivation, except by express permission of the Intendant and on his being furnished with satisfactory proof that the second parcel is required for the *bonâ fide* purpose of bringing it under cultivation at an early date.

Rural Land shall be land other than land reserved or land required to be reserved or Town or Village Lots or land forfeited to the Crown. Rural Lands may be sold after survey on approval by the Sub-Intendant at the cash price of Two pounds Ten shillings sterling an acre which sum will include the cost of survey and Grant and Assurance Fund contribution to the Real Property Ordinance.

Such further price as the Governor may direct may be charged as improved value in respect of any land which may be cultivated or otherwise improved.

Swamp Lands in the case of parcels not exceeding five acres may be sold at an upset price of Two pounds sterling an acre to cover all fees and contributions as before stated.

Petitions for parcels of land comprising more than one hundred acres shall be submitted in the first instance through the Sub-Intendant to the Governor, who shall fix the price for the same, such price not to be less than Five pounds sterling an acre except in special instances and by permission of the Secretary of State for the Colonies.

Given under my hand and the Seal of the Colony
at Government House, Port-of-Spain, this
first day of April, 1914.

By His Excellency's Command,

F. GANTEAUME,
Sub-Intendant of Crown Lands.

AGRICULTURAL BANKS.

REPORT OF AGRICULTURAL CREDIT SOCIETIES IN ST. VINCENT.

The St. Vincent Credit Societies Ordinance, with its accompanying rules and regulations has been printed in this Bulletin, and has formed the basis of discussion at the meetings of the District Agricultural Societies and other bodies who are considering the question of the introduction of co-operative credit in this Colony. It will therefore be of direct interest and advantage to reprint from the *West India Bulletin* XIV. 1914, pp. 75-79 the first report on the societies established in St. Vincent, written by Mr. R. M. Anderson who is the Secretary of the Administrative Committee appointed to assist the Registrar of Agricultural Credit Societies in that Colony:—

The Hon. C. Gideon Murray, the Administrator of the Colony, having recognized the necessity for pecuniary assistance to the peasant proprietors, resolved to provide them with facilities for obtaining money for the development of their lands and business through means of a common guarantee or a system of mutual liability for loans made to persons collectively forming themselves into Agricultural Credit Societies. Accordingly, in the year 1910 an attempt was made to establish experimental Agricultural Credit Societies on the Raiffeisen system in accordance with certain model rules which were circulated. Two societies were formed—one at Quesielles and the other at Lowmans (near Kingstown).

The result of this venture being satisfactory, the Administrator proceeded to perfect his scheme designed to provide agencies and sources whereby the peasantry would be capable of negotiating loans for short periods under advantageous terms instead of at the prevailing exorbitant interest running sometimes as high as 100 to 120 per cent. per annum. In June, 1913, an Ordinance was submitted to the Legislature for the registration, encouragement, and assistance of Agricultural Credit Societies under the Raiffeisen system. It was passed on the 29th day of July, 1913, and was brought into operation on the 4th day of September of the same year.

A memorandum containing complete particulars for the guidance of persons desiring to form Agricultural Credit Societies was distributed gratuitously in the month of August, 1913. Appended to it were certain necessary forms including model Articles of Association and a form of application for registration of a society.

The Registrar of the Supreme Court of Judicature is constituted the Registrar of Agricultural Credit Societies by the Ordinance, in which provision is also made for the appointment of a committee to assist him in matters relating to such societies.

The members of the Committee are:—

The Registrar—Hon. R. E. Noble, Chairman.

The Chief of Police—Major J. A. Meldon (recently promoted to Grenada).

The Superintendent of Crown Lands—Mr. J. Landreth Smith.

The Agricultural Superintendent—Mr. W. N. Sands.

The Secretary is the Chief Clerk in the Registrar's Office—Mr. Robert M. Anderson.

In view of their official duties all the officers of this committee are in touch with the peasantry. The Administrator's motive therefore for the selection of these officers to be members of the committee needs no explanation.

The duties assigned to the Committee and embodied in regulations are, mainly, to ascertain before registering a society that—the society is composed of persons known to be honest, industrious and thrifty, and that the persons whose names are submitted for the various offices and their sureties possess the required qualifications; also to advise and to make recommendations concerning any other matter for carrying into effect the provisions of the Ordinance.

Six societies were registered on the 24th day of November, 1918, (a little over two months after the passing of the Ordinance), comprising a total number of 185 members. These societies are located in different parts of the colony. A short description of each of these registered societies, their membership and location may here prove of interest.

- (1.) The Georgetown Agricultural Credit Society consists of fourteen members. The Rev. A. J. Cocks is the Treasurer and Secretary, the Trustees are Messrs. John Samuel Dick and John Pierre Louis and the Chairman is Mr. Edward Gatherer, the last three of whom are peasant proprietors. All the lands in the occupation of these members are situated toward the mountains where they cultivate arrowroot, cacao, ground provisions, cassava and sugar-cane. This town is on the eastern side of the island, 22 miles from Kingstown.
- (2.) The Society at Union has nineteen members. The Rev. A. J. Cocks is also the Treasurer; Mr. Jonathan L. Adams, a schoolmaster, is the Secretary; Mr. R. C. A. Morris, a shop-keeper and peasant proprietor, is the Chairman and a Trustee, and Mr. James P. Smart a planter and peasant proprietor, is the other Trustee. On their lands, all of which are toward the mountain, they cultivate arrowroot, cacao, cassava, ground provisions and sugar-cane. This village is 15 miles from Kingstown on the eastern side of the island.
- (3.) At the village of Stubbs, also on the eastern side of the island, 9 miles from Kingstown, the Agricultural Credit Society consists of eighteen members. The Treasurer and Chairman is the Rev. E. A. Pitt; the Secretary is Mr. H. E. A. Daisley, a schoolmaster; the Trustees are Messrs. Charles Huggins and Shadrach Toussaint. On their mountain and low lands they cultivate cotton, arrowroot, ground-nuts and ground provisions.
- (4.) The society at Lowmans, which place is 2 miles from Kingstown in a northern direction, has struggled along since the first attempt in 1910 to which I have alluded. It has been re-organized to comply with the Ordinance and has nineteen members. The Governor-in-Council approved the appointment of Mr. David Gumbs as Treasurer. He is a well-respected peasant proprietor, Mr. Joseph Ash, Crown Lands Ranger, is

the Secretary; Messrs. Jonathan Charles and Samuel Williams are the Trustees, and Mr. Walcott Scott is the Chairman. All possess small parcels of land toward the mountain and lower elevations on which they grow cotton, cassava, arrowroot and ground provisions.

- (5.) The Agricultural Credit Society at Troumaca has thirty-nine members—a larger number than any other similar society. The Treasurer is Mr. Richard Anthony, a thrifty and highly esteemed peasant proprietor for whose appointment the approval of the Governor-in-Council was obtained, Mr. Jeremiah Providence is the Secretary and Messrs. Jonathan Richards and Samuel Lawrence are the Trustees. They are all in possession of small holdings. The Chairman, Mr. T. W. Clarke, a schoolmaster, has done good service in the neighbourhood in this and other connexions. The Post Office and telephone for the benefit of the people are at his residence; and for the cotton competition of this year he was awarded the highest prize. Troumaca is a fertile village on a gradual slope 18 miles from Kingstown in a north-western direction. It was once famous for ground provisions and live stock, most of which were exported. Cotton is principally grown on the low lands at the present time; small quantities of arrowroot, cassava, and sugar-cane are also produced.

- (6.) The society at Chateaubelair has twenty-six members. The Rev. C. G. Errey is the Treasurer; Mr. D. A. Dennie, a schoolmaster, is the Secretary; Messrs. Joseph Hamilton and Emmanuel Charles, peasant proprietors, are the Trustees, and Mr. Jonathan G. Morgan, a shopkeeper and proprietor of 90 acres of land, is the Chairman. All the members own mountain lands, two only possess coastal lands and two both coastal and mountain lands. Cacao is the principal product; sugar-cane and cassava are grown to a limited extent. This town is 21 miles from Kingstown in a north-western direction.

In the capacity of Secretary to the committee appointed by His Honour the Administrator I have attended a few of the preliminary meetings of societies in course of formation. It afforded me pleasure to participate in the deliberations, and especially to listen to the gratitude earnestly expressed for the extended solicitude of the Government toward the welfare of the people. This also gave me the opportunity to confirm my opinion, that the Registrar or other Government Officer authorized to inspect the books, etc., of the society could render valuable assistance by discussing with the members any problem they need help to solve. On such occasions he should endeavour to impress upon them the essential importance of frugality to enable them to fulfil their obligations and ensure their continued usefulness as well as solvency. Their success will thereby be greatly enhanced and additional confidence in the Government inspired by this continued interest in their affairs.

My experience in regard to the organization and working of societies, composed chiefly of natives in the humbler stations of life, proved of great value to me. For example, a man of this class who knows his

neighbour to be improvident and perhaps dishonest is in most cases very reluctant to object to his membership. Here, therefore, is a proof of the importance of the investigations of the character of members by the Registrar's committee referred to earlier in this paper. In addressing them I suggested the taking of votes by ballot or on pieces of folded paper marked "yes" or "no," and I urged the adoption of a manly attitude, illustrating how an indifferent and extravagant friend or brother who fails because he does not deserve to succeed, could make it possible for a careful person to be dispossessed of that for which he laboured hard and which he intended to pass to his children or relations. I spoke also on subjects not connected with Agricultural Credit Societies. In one place I admonished them for their unwillingness to repair and maintain pathways to their plots of land, explaining, among other things, that although other persons may not escape infection of a disease arising from their insanitary habits, those in their village would certainly suffer first and fatally, in all probability. A few members responded, regretfully admitted their errors, promised to correct them and to advise others accordingly. It has since been reported to me that these roads have been cleaned and repaired and a few names removed from those of persons who are endeavouring to establish an Agricultural Credit Society in that particular village.

The mutual co-operation and mutual liability are thoroughly understood; questions have arisen and each point made clear. They now have an entire grasp of every detail and are striving to the utmost to attain those objects for which the society is intended. If they be fortunate to achieve the share of merit proportionate to their honesty of purpose and their exertions it should result in a far more prosperous condition than any in which they have ever been.

In a few of the societies the more intelligent members are preparing to execute the plans they long ago conceived for their advancement but which were rendered impracticable by lack of funds. Among them is the manufacturing of their produce themselves rather than submitting to the inconvenience now experienced by being forced to convey their produce to the nearest estate for manufacture and the excessive charges which consequently diminish their profits. There is for instance a great demand locally for syrup and muscovado sugar. In fact, traders from the Grenadines have not infrequently taken back their money because they failed to obtain syrup.

To what extent the societies will succeed depends principally on the patronage of depositors and investors: in this respect it is unfortunate but nevertheless true that in St. Vincent there are few who would be willing to support this project of the Government to a considerable degree. The Provident Societies at various parts of the island, however, may not be unwilling to invest their surplus funds with the Agricultural Credit Societies and in that way extend their usefulness in another sphere. The expediency of this proposal has already commended itself to several persons who are members of both the Provident and Agricultural Credit Societies in the same parish and it is confidently believed that the desired object will be accomplished. The Colonial Bank is also being approached with a view to ascertaining whether that bank will not give

the same facilities for loans to Agricultural Credit Societies in St. Vincent as some twenty large banks in England are granting to similar Agricultural Credit Societies in England.

The thriftless, and those addicted to unprincipled habits, are being scrutinized and excluded as far as possible from membership, but admitting that a few of them become members, the difficulties to be encountered thereby should be regarded as transient, for they most probably will disappear like the ripened flower that falls when the fruit matures.

Applications for Government loans from the registered societies at Georgetown, Union, Chateaubelair, and Troumaca, representing a total sum of £294 have been recommended to the Governor-in-Council by the Committee appointed under the provisions of the Ordinance, and this amount will probably be loaned to these societies during the month of January, 1914. For the present the Governor-in-Council has power under the Ordinance to loan to registered societies a sum aggregating £500. It is sincerely hoped that private enterprise will supply such balance as may be required, and that Agricultural Credit Societies on the Raiffeisen system will prove as stable an investment and as successful in St. Vincent as they have shown themselves to be in every other country where they have been adopted.

CO-OPERATIVE CREDIT IN BURMA.

Attention has already been directed in this *Bulletin* (p. 132) to the very successful results which have followed the introduction of co-operative credit into India. One of the great advantages of the co-operative credit system is that whilst maintaining the essential features they can be modified to suit special local conditions. The following account of how this has been successfully accomplished in Burma, one of the Provinces of the Indian Empire, will be of interest in this Colony at the present when efforts are being directed to finding out and overcoming the difficulties which lie in the way of the introduction of co-operative credit. The extract is taken from a paper by Mr. H. Clayton, officiating Director of Agriculture, Burma, in the *Agricultural Journal of India*, ix, 1914, pp. 7-22.

It is now eight years only since its first introduction into the province, and already the framework of a complete organisation of the agricultural classes on co-operative lines is making its appearance, of which the most remarkable feature is the spontaneous character of its growth. Burma owes a debt of gratitude to its present Registrar of Co-operative societies which it would be impossible to overestimate, and one of the main causes of the success of his administration has been the fact that he has never sought to go constitution-mongering or to impose a cut-and-dried scheme of organisation based on foreign precedents upon the country. He has been content to sow the seed, and once the plant has taken root in the bed prepared by him, he has been quick to perceive the shoots thrown out by it and to guide their growth on sound and productive lines. The result is that the co-operative movement has definitely Burman characteristics of its own, and instead of being an exotic may be regarded as an indigenous production thoroughly suited to the soil on which it has to grow.

Surprises there have been in the past, in its development, even to those who have watched it from close quarters, though most of them have proved pleasant ones ; and even now it is not possible to foretell with any accuracy the exact details of the future structure. But a brief description of the framework of organisation already created may be of interest. The basis of the structure is the local village Society, based on the unlimited liability of all its members. These Societies, to the number of 20 or thereabouts lying within an area of 8 miles or more from a common centre, form a union, each constituent society of which is surety for the loans contracted by the rest, to the extent of the outside loans which it itself has accepted. These Unions are the unofficial driving force of the movement. Through their elders and the Union clerk they instruct, supervise, and generally control the working of their affiliated societies. For the better realisation of these objects three or more Unions combine to maintain an Inspector paid for from Union funds which, in their turn, are provided by a Union rate levied upon the subordinate societies. The activities of the Unions do not stop short at the organisation of credit, and it is through their agency that other branches of co-operative effort—such as sale, purchase, or cattle insurance—are being organised, sometimes by the founding of separate societies, sometimes by the direct action of the Union alone. The Union is thus taking much the same place in Burmese co-operation as that occupied by the 'Syndicat agricole' in France, though the organisation of the two bodies is altogether different. As Unions become numerous in any district a further development is appearing, in a district conference, meeting twice a year. This is a new venture tentatively started in the early months of 1918, but which has now received the definite approval of the movement at the Biennial Provincial Conference in August last.

FISHERIES.

EXPERIMENTS WITH TURTLES.

Conducted by the Danish Commission [for Ocean Research.

The following correspondence was published for general information in the *Royal Gazette* for April 9, 1914:—

ST. THOMAS,

March 13, 1914.

SIR,

I have the honour to approach Your Excellency on the following matter:—

The Danish Commission for Ocean Research has requested my assistance in respect of experiments with marked turtles, that have been released in the sea around the Danish West India Islands.

I have issued the herewith enclosed publication in the islands under my Government.

As, however, it is likely that some of the marked turtles may wander to other places and possibly be caught in the neighbouring islands, and as it would be of great importance to the Commission to obtain reliable information about the turtles caught there, I take the liberty to solicit Your Excellency's good assistance towards procuring such information as far as the islands under your Government are concerned.

The matter would appear to me to be of international interest and I should be very grateful for Your Excellency's co-operation for a good result of the experiments.

I am prepared to reimburse Your Excellency for all expenses you may incur in the matter.

I have the honour to be, Sir,

Your Excellency's most obedient Servant,

(Sgd.) BAUMANN,
Acting Vice-Governor.

(Sgd.) T. H. BERNER.

To His Excellency the Governor,
Port-of-Spain, Trinidad.

Translation.

PUBLICATION.

The Commission for Ocean Research has released in the sea around the Danish West India Islands a number of marked turtles, especially "green turtles," in order to try thereby to get reliable information about the wanderings and the growth of these animals. The marks consist of the letters D. A. (Denmark) and a number, and are burnt into the shield which covers the back of the turtle and stamped on a small silver clip which is fastened into the tail plates. All the marked turtles are carefully weighed and measured before being returned to the sea.

When such marked turtles are caught again the following elucidations are desired: (1) the date of the catch, (2) the place of the catch, (3) the weight, (4) the length and the greatest breadth of the back shield, also eventually (5) the sex of the specimen.

For sending in these elucidations along with the numbered silver clip, the Commission will pay the finder a reward of one dollar.

It will further be of importance for the Commission to come into possession of the back shield of recaptured marked turtles and the Commission is therefore willing to pay a suitable compensation when the back shield is also sent in.

The marks, information, etc., to be forwarded to Government which pays the offered premiums.

Government of the Danish West India Islands, St. Thomas, March 18, 1914.

(Sgd.) BAUMANN,
Acting Vice-Governor.

(Sgd.) T. H. BERNER.

PUBLICATIONS RECEIVED.

The Corn Crops, by E. G. Montgomery, pp. XVII and 847. The Macmillan Company, New York, 7s. 0d. 1918.

The author of this volume in the well-known Rural Text Book Series is Professor of Farm Crops in the New York State College of Agriculture at Cornell University; under the designation Corn Crops he deals with maize or Indian corn, and the sorghums or Guinea corn, by far the greater part of the book being devoted to maize. The mode of treatment is to study the art of crop production in relation to the scientific principles on which practice is based, the four general phases being (1) the plant, its structure, physiology and normal requirements, (2) a general survey of the region where it is proposed to cultivate the plant, (3) adaptation of the plant to natural condition and adaptation of the soil to the needs of the plant, (4) protection against other plants, fungoid diseases and insects.

Following this treatment of the subject the author brings together a useful mass of information relating particularly to maize and sorghums in the United States and Canada. Much of this information however will be found equally useful to the planter in this Colony where corn should certainly be more extensively grown than it has been in the past. Professor Montgomery points out that the exportation of corn from the United States is decreasing and the home consumption will soon equal production, in fact for the past three years corn has been imported on the Pacific Coast of the United States. The accounts of the selection of corn are of interest, and the practical information on cultivating and harvesting corn contain many useful hints. The various chapters have appended to them a good bibliography of the subjects dealt with. The book is well illustrated.

All About Coconuts, by R. Belfort and A. J. Hoyer, pp. XII and 201. St. Catherine's Press. London, 1914. Price 6s. 0d.

Emphasis is laid in this volume on the anticipated boom in coconuts which is doubtless responsible for the recent rapid succession of books on what was until recently one of the comparatively neglected plants of the tropics, so far as literature was concerned. General information is given regarding most phases of the cultivation of the coconut and the treatment of its various products, including estimate of the cost of production to bearing age, (taken as 6 years) ranging from £3 per acre in Meconsia to £14 5 9 in the Federated Malay States. In the estimate given in this *Bulletin* (XI 1912 pp. 173-8) the working capital of 500 acres was estimated at £18,148 or £36 per acre. This is admittedly a cautious estimate, but unless estimates are cautious or conditions are exceptionally favourable financial success will not attend all ventures in the production of coconuts.

The World's Rubber Position : Compiled and published monthly by Messrs. W. H. Rickinson and Son, 89, Winchester Street, London Wall, E.C. Single copies 2s. 0d. Annual subscription 15/- post free.

The contents of the March 1914 issue include general notes on the rubber industry of all parts of the world, detailed statistics of imports, exports, stocks and prices in the chief markets and special summaries of consumption of rubber in the United States and Canada 1899-1913, exports from Para 1900-1913, the world's area under plantation rubber 1905-1913 and many other matters of interest.

Materials and Methods in High School Agriculture, by W. S. Hummel and B. R. Hummel, pp. XII and 385. The Macmillan Company, New York, 1913. Price 5s. 6d. net.

The scope of this book is a discussion on broad lines of courses of instruction in agriculture suited to the requirements of pupils in high schools in countries such as the United States. The authors deal fully with general principles and methods and much that they say can be put to practical use in other countries also. They recognise that but few of the members of an agricultural community can attend special agricultural schools and colleges and that to have a progressive, well informed, agricultural population proper instruction must be given in the schools.

A very full account is given of courses of instruction in American schools, including horticulture, poultry farming, animal husbandry, the working of school farms; the necessary qualifications of the teachers are also discussed at length. Although much of the information given is applicable to a later stage of development than has yet been reached in most West Indian communities the book will be of interest to those concerned with agricultural teaching.

The Living Plant, by W. F. Ganong, pp. XIV and 478. Henry Holt & Co., New York, 1913. Price \$3.50 (14 s. 7d.).

Dr. Ganong is well known to students of botany as the author of books in which often well known facts are given, new interest by being treated in a fresh and unconventional manner. This volume in the American Nature Series is no exception. It is intended primarily for the beginner, before whom it places the essential points regarding the physiology of plants in interesting and clear form. In other words it deals with plants as living things and describes the methods by which they obtain their nourishment, propagate their kind, adapt themselves to surrounding conditions and generally make their way in the world. The origin of new forms, including the improvements effected by man are not neglected, and the volume as a whole with its wealth of illustrations, mostly new, will prove of great interest to all interested in plant life, whether as gardeners, agriculturists, or simply observers of nature.

W. G. F.

NOTES.

A FACTORY for the manufacture of cassava starch has recently been established by the Trinidad Produce Co., Ltd., at Carenage, Diego Martin. A visit was paid on May 11 by Her Highness Princess Marie Louise of Schleswig Holstein, His Excellency the Governor, Lady Le Hunte and others, on the invitation of Mr. Alfredo Siegert, when the complete process of making starch was demonstrated. The factory is also equipped for the manufacture of lime juice, citrate of lime and subsidiary products, the Company having a large cultivation of limes adjacent to the factory.

A Horticultural Club has been formed for the encouragement of horticulture in all its branches in Trinidad and Tobago. The Club which includes amongst its objects courses of instruction to working gardeners is fortunate in having received a promise of financial support to the extent of \$500.00 per annum for five years from Mr. J. W. Stephens, its first President.

His Excellency the Governor has granted a request made by the Scarborough String Band to play in the Botanic Station, Tobago, on Sunday afternoons and one other afternoon each week.

Mr. W. G. Freeman has been elected Deputy Vice-President of the Agricultural Society of Trinidad and Tobago.

In the Cacao and Vegetable Prize Competitions of 1914-15 Mr. A. Brunton will be the Agricultural Inspector in the Oropuche and Erin Districts, and Mr. F. T. Farfan in the Brasso and Caparo districts.

Another new industry will probably soon be established in Trinidad. As the outcome of experimental work and investigations which have been made during the past two years a British company is taking up a large area of land for the cultivation of bamboo and the manufacture of bamboo paper-pulp.

The budding of cacao continues satisfactorily. At St. Clair Experiment Station there are now some 200 plants budded from selected trees on to Calabacillo stocks since March. At River Estate budding on plants in the open also promises to be successful.

METEOROLOGY.

RAINFALL RETURN FOR JANUARY TO APRIL, 1914.

Stations.	1914.		1913.	
	April.	Jan. to April.	April.	Jan. to April.
<i>North-west District.</i>				
	Ins.	Ins.	Ins.	Ins.
St. Clair—Royal Botanic Gardens ...	1'01	3'40	0'42	5'14
Port-of-Spain—Colonial Hospital ...	1'45	2'96	0'10	4'15
„ Royal Gaol ...	1'37	3'26	0'46	5'53
„ Constabulary Hdqrs. ...	1'26	3'45	0'23	5'39
St. Ann's—Reservoir ...	1'05	4'05	0'21	5'54
Maraval— „ ...	1'38	5'46	0'80	6'72
„ Constabulary Station ...	1'87	4'92	0'58	6'87
Diego Martin—Constabulary Station ..	1'32	4'36	0'34	6'73
„ Waterworks ...	1'47	4'43	0'50	7'37
„ River estate ...	1'66	4'38	0'43	7'29
Fort George Signal Station ...	1'23	5'35	0'32	6'31
North Post „ ...	0'66	3'48	0'10	6'25
Carenage Constabulary Station ...	0'74	5'15	0'68	7'79
Carrera Island Convict Depot ...	0'54	2'40	0'51	4'47
Chacachacare Lighthouse ...	0'98	3'88	0'58	5'52
<i>Santa Cruz—Maracas District.</i>				
Santa Cruz—Constabulary Station ...	0'89	4'41	1'40	9'13
St. Joseph—Government Farm ...	3'38	6'16	0'78	6'60
„ Constabulary Station ...	3'01	5'25	0'36	5'20
Tunapuna—St. Augustine estate ...	3'50	6'57	0'64	4'84
Maracas—Government School ...	0'95	4'47	0'54	10'84
„ Ortinola estate ..	1'08	6'28	0'72	10'51
Caura—Wardour estate ...	2'00	5'29	0'46	6'66
<i>West Central District.</i>				
Caroni—Frederick estate ...	3'77	14'75	2'74	18'65
Chaguana—Constabulary Station ...	0'69	4'59	1'35	9'30
„ Woodford Lodge estate ...	0'90	5'00	1'25	9'00
Carapichaima—Waterloo estate ...	1'83	5'20	0'85	9'36
„ Friendship Hall estate ...	1'46	5'72	0'87	10'91
Couva—Exchange estate ...	0'85	2'53	0'10	6'27
„ Brechin Castle estate ...	1'55	4'01	0'31	7'75
„ Perseverance „ ...	1'11	4'00	0'30	6'82
„ Camden „ ...	0'86	2'56	1'38	10'18
„ Milton „ ...	1'59	3'17	0'16	7'02
„ Spring „ ...	0'94	3'92	0'43	9'85
„ Constabulary Station ...	1'33	2'93	0'15	5'34
„ Esperanza estate, San Natta... ..	1'70	2'98	0'19	7'30
<i>San Fernando & Princes Town District.</i>				
Claxton's Bay—Forres Park estate ...	1'29	3'22	0'15	7'74
Pointe-à-Pierre—Bonne Aventure est. ...	1'08	5'03	0'27	9'12
„ Concord estate ...	0'80	4'36	0'33	9'88
„ Plein Palais estate ...	0'89	2'72	0'20	7'82
Naparima—Picton estate ...	0'58	4'27	0'37	6'83
„ Usine St. Madeleine estate ...	1'68	4'48	1'05	10'62
„ La Fortuné estate ...	0'60	3'25	0'60	7'82
„ Lewisville, San Fernando..	1'64	5'12	0'75	11'14
„ Tarouba estate ...	0'54	2'55	0'13	6'69
„ Union Hall „ ...	1'62	4'74	0'51	6'12
„ Palmiste „ ...	0'96	3'78	0'01	8'64
„ Hermitage „ ...	0'95	5'06	0'86	7'16
Princes Town—Craignish „ ...	1'55	6'94	1'42	9'85
„ Cedar Hill estate ...	1'40	6'64	1'26	8'75
„ Williamsville estate ...	0'50	0'49	0'45	10'55
„ New Grant estate ...	1'54	7'63	1'22	11'02
„ Constabulary Station... ..	0'55	3'09	1'05	8'40
„ Hindustan estate ..	1'15	6'40	1'79	10'62

RAINFALL RETURN FROM JAN., TO APRIL, 1914.—CONTD.

Stations.	1914.		1913.	
	April.	Jan. to April.	April.	Jan. to April.
<i>San Fernando and Princes Town District. (Cont'd.)</i>	Ins.	Ins.	Ins.	Ins.
Princes Town—La Retraite estate ...	175	1251	113	1372
"—Malgretoute estate ...	136	589	116	915
"—Esmeralda Estate ...	112	689	047	1131
Savanna Grande—Friendship and Ben Lomond estates ...	156	544	058	856
Poole—El Rosario estate ...	087	798	144	1952
<i>Montserrat District.</i>				
Montserrat Constabulary Station ...	178	518	024	1021
Brasso—La Vega estate ...	077	664	071	1201
<i>Arima District.</i>				
Arima—Warden's Office ...	022	461	020	332
"—Torreilla estate ...	337	1078	136	998
"—Verdant Vale estate ...	319	893	098	1077
San Rafael—Constabulary Station ...	279	1104	141	1442
Guanapo—Talparo estate ...	135	732	148	1359
Tamana—Sta. Marta estate ...	170	1039	132	1642
<i>South-west District.</i>				
Oropuche—Constabulary Station ...	195	626	072	848
"—Pluck estate ...	117	447	035	675
Siparia—Constabulary Station ...	204	1093	231	1238
Guapo—Adventure estate ...	052	379	067	809
Cap-de-Ville—Constabulary Station ...	167	728	274	1398
Erin—La Ressource estate ...	047	181	259	1040
"—Industry estate ...	043	630		
Cedros—Constabulary Station ...	032	776	179	897
"—Perseverance estate ...	031	579		
Teacos—Constance estate ...	009	267	110	1057
Irois—Irois estate ...	107	789	223	1241
<i>South Coast.</i>				
Moruga—Constabulary Station ...	109	618	061	1252
<i>North Coast.</i>				
Blanchisseuse—Constabulary Station ...	047	550	174	1933
Grande Rivière—Mon Plaisir estate ...	200	1145	132	2424
Toco—Aragna House ...	104	724	106	1779
"—Constabulary Station ...	095	730	116	1784
Point Galera—Light House ...	017	308	005	796
<i>East Coast.</i>				
Matura—La Juanita estate ...	157	812	243	2074
Manzanilla—Constabulary Station ...	210	879	062	1859
Sangre Grande—Sta. Estrella estate ...	370	1423	117	2095
"—New Lands estate ...	361	1140	130	2206
"—Evasdale estate ...	396	1354	144	1751
"—Grosvenor estate ...	371	1181	125	1774
Mayaro—Constabulary Station ...	295	643	101	1558
<i>Tobago.</i>				
Tobago—Hermitage estate ...	174	1042	153	1743
"—Riversdale ...	027	457	045	1091
"—King's Bay ...	096	950	091	1487
"—Roxburgh ...	085	1146	112	1877
"—Lure estate ...	131	1181	114	1636
"—Botanic Station ...	047	525	074	787
"—Government Farm ...	003	233	058	492
"—Lowlands estate ...	021	342	026	665
"—Friendship estate ...	056	*	050	801

(Bulletin, Department Agriculture, Trinidad & Tobago, pp. 139-175. Issued June 2, '14)

* Not received.

BULLETIN

OF THE
DEPARTMENT OF AGRICULTURE,
Trinidad and Tobago.

VOL. XIII.]

JUNE, 1914.

[No. 81.

CACAO.

CACAO PRIZE COMPETITION 1913-14.

Report of the Judges and Prize Lists.

THE third year's work in the Cacao Prize Competition has now come to a close. Interest has been well maintained, the entries in the St. Ann's and Diego Martin districts being 132 and in the Couva and Chaguanas districts 190. A special Competition was a new feature this year: Prizes and medals were offered for competition amongst the prize winners of previous years, irrespective of what district their holdings were in.

The report of the judges, which are given in full, indicate the useful work which is being accomplished in this branch of agricultural education in the Colony. It is to be hoped that in the near future means may be found for such efforts to be made in all districts and to be continuous. In the competition of 1914-15 the Board of Agriculture has offered additional prizes for Vegetable cultivation.—(W. G. F.)

SPECIAL PRIZE COMPETITION.

This competition was held this year for the first time, the competition being limited to those who had won a prize in any district in the two previous years. The judges, Mr. J. C. Augustus, Superintendent of River Estate and Curator of the Botanic Gardens, and Mr. D. C. Plummer, Assistant Superintendent of Field Experiments, report as follows:—

As directed, we inspected and judged the cultivations of the competitors in the Special Cacao Prize Competition.

Commencing on Monday, March 16, we completed the work on Friday April 17. There were, originally, 18 competitors in Class I., but one died and one withdrew owing to a family bereavement, leaving 16 in Class I. All the competitors in Class II—16—have been judged making a total of 32.

We have gone carefully over the work of each competitor and adjudged the prize winners as follows :—

CLASS I. — PEASANT PROPRIETORS.

Order.	Value of prize.	Name.	Marks.	Nationality.	Acreage.	District or Estate.	Ward.
1	Medal & \$20	Khanhai Meah ...	98	East Indian ...	11	Longdenville	Chaguanas
2	Medal & \$10	Apollo H. Romany	93	Trinidadian ...	10	Negre Maron	Maraval.

CLASS II.—CONTRACTORS.

Order.	Value of prize.	Name.	Marks.	Nationality.	Average.	District or Estate.	Ward.
1	„ „	Benjamin Croney	100	Barbadian ...	6	Endeavour Estate ...	Chaguanas
1	„ „	Soomaroo ...	100	East Indian ...	3	Green Hill Estate ...	Diego Martin
	„ \$5	Apoul J. Baptiste	98	East Indian ... (from Gaude-loupe)	7	San Reno Estate ...	Turure.
2	„ „	Seno Joseph ...	98	Trinidadian ...	6	Mon Desir Estate ...	Santa Cruz.

We cannot speak too highly of the work carried on generally by the Competitors, many of whom received high marks.

In Class I. the first prize winner, Khanhai Meah, received a total of 98 and Apollo H. Romany the second prize with a total of 93 marks. Both competitors did excellent all-round work and cannot be too highly commended.

We must also record our appreciation of the work done by Thomas L. Barnard of Sisters Road, Savana Grande, who is placed third with a total of 91.

In Class II. it will be observed that the first two competitors, Benjamin Croney, and Soomaroo, received the maximum marks. Their

work is deserving of the highest praise. Both contracts were seriously attacked by cacao beetles which have been thoroughly and systematically kept under control by modern methods. In tillage, these competitors were considered perfect, having performed all necessary work in a thorough and systematic manner.

The next two competitors, Apoul Jean Baptiste and Seno Joseph were very nearly perfect and deserve very high commendation for their excellent work.

As the first two competitors obtained the maximum marks and the two next the very high total, 98, we strongly recommend that two first and two second prizes be awarded, as in our opinion, they are thoroughly deserving and merit this award.

We also consider that many of those who have failed to win a prize are deserving of some recognition of merit for their splendid work and we recommend that those competitors who have obtained 90 per cent. of marks, or over be awarded a certificate by the Board.

In conclusion, we have to record our approval of the excellence of the work, generally, of the competitors in this competition, which has been very keenly contested. We are of opinion that the Cacao Prize Competition is awakening a deep interest among Peasant Proprietors and Contractors, and we are satisfied that the competitors are keenly alive to the benefits they have obtained by the instructions of the Board's Inspectors.

(Sgd.) J. C. AUGUSTUS.

D. C. PLUMMER.

Special Cacao Prize Competition, 1913-14.

CLASS I.—PEASANT PROPRIETORS.

Order.	Name.	Value of Prize.	Acreage.	District.	Ward.	Tillage.	Sanitation.	General.	Grand Total.
1	Khanhai Meah ...	Medal & \$20	11	Longdenville	...	50	30	20	100
2	Apollo H. Romany ...	Medal & \$10	10	Negre Maron	Chaguanas	50	28	20	98
3	Thomas L. Barnard ...	...	14	Sister's Road	Maraval ...	44	30	19	93
4	James Norgriff ...	...	16	Four Roads	Sangre Grande	43	28	20	91
5	James Alexander Reid ...	...	12	Plum Road	Diego Martin	46	23	18	87
6	William Walcott ...	...	14	Tamana ...	Manzanilla	42	25	18	85
7	Gangadial Doorbal ...	...	16	Brasso Piedra	Upper Caroni	37	27	18	82
8	Alexander S. Lee... ..	...	11	Longdenville	Montserrat	38	21	18	77
9	Ramdial ...	...	7	Petit Valley	Chaguanas	33	24	17	74
10	Austerlitz Solomon ...	...	5	Caparo ...	Diego Martin	40	15	16	71
11	Marie T. Bodu ...	...	13	Pichon ...	Montserrat	29	21	17	67
12	C. E. Pilgrim ...	...	16	Manzanilla No. 2	Maraval ...	28	21	16	65
13	William Gerry ...	...	9	Torib Trace	Manzanilla	33	17	15	65
14	Jean Didier Severre ...	...	10	Tabaquite	Savana Grande	31	18	12	61
15	Augustine John ...	...	12	Todd's Road	Montserrat	23	12	10	45
16	Alberton W. Watts ...	...	14	Tableland	Chaguanas	15	9	10	34
					Savana Grande	12	6	4	22

Special Cacao Prize Competition.

CLASS II :—CONTRACTORS.

Order.	Name.	Value of Prize.	Acreage.	District.	Ward.	Tillage.	Sanitation	General.	Grand Total.
1	Benjamin Croncy	Medal & \$10	6	Chaguanas	Chaguanas	50	30	20	100
1	Soomaroo	Medal & \$10	3	Green Hill	Diego Martin	50	30	20	100
2	Apoul Jean Baptiste	Medal & \$5	7	Sangre Chiquite	Turure	49	30	19	98
3	Seno Joseph	Medal & \$5	6	Gasparillo	Santa Cruz	50	29	19	98
4	Pitz-Herbert Alleyne		3	Moruga Road	Savana Grande	44	30	20	94
5	Brathwaite Joseph		5	Brasso Piedra	Montserrat	43	30	19	92
6	George de Souza		3	Sangre Grande	Manzanilla	44	29	18	91
7	Joseph Daniel		4	Sisters Road	Sangre Grande	42	30	18	90
8	Julien Joseph		10	Grande Curucaye	Santa Cruz	36	24	16	76
9	Noble Thomas		3	Upper Cunapo	Manzanilla	33	25	17	75
10	J. La Rose Timson		6	Tucker Valley	Carenage	34	22	15	71
11	Howard Nicholas		3	La Canoa	Santa Cruz	28	24	14	66
12	George Frederick		5	Sangre Chiquite	Turure	28	23	14	65
13	Francis Littrean		8	Fond Palmiste	Diego Martin	16	22	12	50
14	Samuel Glaude		6	Tucker Valley	Carenage	18	15	10	43
	Joseph Hogan			Caigual	Manzanilla	21	12	10	43

DIEGO MARTIN AND ST. ANN'S DISTRICTS.

The judges in this competition were Mr. G. G. Brown a planter, Mr. D. C. Plummer and Mr. L. A. Brunton the Agricultural Inspector in charge of the work during the year—Their report is as follows:—

We have the honour to report that we commenced judging the cultivations entered in the Cacao Prize Competition on Thursday 19, and concluded on Monday, March 30, during which time we visited and examined twelve peasant proprietor's cacao cultivations and fourteen contracts. We find that the best in the two classes are:—

CLASS I.—PEASANT PROPRIETORS.

Order.	Value of Prize.	Name.	Marks. (100).	Nationality.	Acreage.	District.	Ward.
1	\$90	Sylvestre Pequette	84	Trinidadian	7	Cimaronero	Cimaronero.
2	{ 55	Lallsingh ..	83	Indian ...	9	Petit Valley	D'go Martin.
	{ 55	Julien Webster...	83	Trinidadian	6	Cyril Bay ...	Santa Cruz.
4	30	Ramlochan ...	79	Indian ...	5	Petit Valley	D'go Martin.
5	20	John Edward ...	74	Grenadian ...	6	Gasparillo ...	Santa Cruz.

CLASS II.—CONTRACTORS.

1	\$60	Sumarie ..	87	Indian ...	3	Green Hill..	D'go Martin.
2	50	Louis Thomas ..	82	Trinidadian	10	Champs	
						Elysee...	Maraval.
3	30	Joseph Simeon ...	76	do. ...	5	Jamson ...	Chaguaramas
4	20	Gungadeen ...	75	Indian ...	4	Green Hill ...	D'go Martin.
5	15	James Johnson ...	72	Grenadian ...	4	Mon Desir...	Santa Cruz.
	{ 7.50	Emile Joseph ...	71	Trinidadian	5	Grand	
6	{ 7.50	Felix Pamella ..	71	do. ...	4	Curucaye	Santa Cruz.
						Paradis	
						Terestre...	Santa Cruz.
8	5	Herbert Capriata	69	do. ..	4	Tucker	
						Valley...	Carenage.

We therefore recommend that all the prizes be awarded in each Class, but as a tie has occurred in Class I for second place and in Class II for sixth place, we desire to suggest that in the former case, the second and third prizes be divided between the competitors who have tied, but that in the latter, should funds permit an extra prize be given, so as not to exclude the competitor who has gained eighth place as he is but two marks behind the sixth, and it is a distinct advantage to the objects of the competition that prize winners should be distributed as much as possible through the Wards, this would ensure, at least, one prize winner in each Ward, but in any case we recommend that a certificate be awarded him.

We have been very favourably impressed by the *tillage* of all the prize winners, it was an agreeable surprise to find that contour drains had been adopted by all those competitors whose cultivation is situated on hillsides, these had taken the forms either as simple drains or roads and in a few instances a combination of both, with the addition of mulch pits to further assist the conservation of moisture and valuable humus; in this

particular it is very encouraging to be able to report that the contractors have done remarkably well, the marks gained by them for draining being generally higher than amongst peasant proprietors, nevertheless the latter have gained a higher percentage of marks in tillage, as a whole their forking and manuring being better.

In *sanitation* there is little to choose between the two classes, in point of marks contractors show a slight superiority, but it must be borne in mind that their trees are usually very much younger and have in consequence, suffered but slightly from former ill treatment, the marks however, under this head vary considerably and point to the fact that there is still ample room for improvement.

The marks gained in *general* by the prize winners are good, ranging as they do from 80 to 90 per cent. with the exception of two contractors who gained 60 and 70 per cent. respectively; the chief facts under this head have been some carelessness in picking and brushing and occasionally a tendency to neglect supplying, particularly minor shade; we consider the first two in particular of sufficient importance to warrant the serious notice of the judges, and accordingly, where they have been observed to occur together the marks awarded to *general* have been rather severely reduced.

A few remarks on the chief points of merit in some of the prize winners will not be amiss. We therefore, desire to record our commendation of the following:

The first three in Class I whose work right through is so nearly alike that a difference of only one mark exists between them.

1st.—Sylvestre Pequette whose *sanitation* is the best in the competition, his gough work, flush cutting and tarring being really very good, in *tillage* also his forking, manuring with pen manure and ashes, and mulching with cacao shell, bush, etc., deserves praise.

2nd.—Lallsingh for his *tillage* and *general*, his forking in the former, for which he received full marks, and hoe weeding and planting of balisier in the latter having especially attracted notice.

2nd.—Julien Webster for his very good *tillage* he having gained the highest marks for this in his Class, but particularly for the excellently dug contour drains, mulch pits and roads.

In Class II, the winner of the first prize, Sumarie for his general all-round work, but especially for *tillage* in which he is first in the whole competition 90 per cent. of the possible marks, and having gained full marks for manuring.

2nd.—Louis Thomas also for the general all-round excellence of his work, his contour drains and mulch pits on the steeper slopes being especially worthy of praise, we desire to emphasize our appreciation of this competitor's efforts, an account of the size of his contract, 10 acres, and the steep and in parts rocky nature of the soil. It will be remembered that this competitor who came eighth in the last competition, 1912-18, impressed the judges so favourably on that occasion that they recommended him for a certificate.

3rd.—Joseph Simeon for his contour drains dug in very steep and rocky soil, and also for his effort to check the wash in the ravines by means of rough walls built across them.

A general review of the competition has led us to the belief that its objects are being gradually attained. Throughout the wide area embraced by the competition, extending from Scotland Bay in the west almost to Maracas Bay in the east, evidence is not wanting of its effect, at least on those who entered either this or the last competition. To mention only a few.

Contour drains on hillsides were absolutely unknown a few years ago, yet we find every competitor presented for judging, has dug more or less effective drains of this description.

The prejudice against forking hill lands was very great a few years ago, yet here again every competitor had done some forking.

The same remark applies to manuring, which, however, in most cases took the form of mulching, all sorts of waste material having been used by competitors for this purpose.

We desire to draw the attention of owners to the fact that these remarks apply with equal if not greater force to contractors, and to suggest that it is greatly to the advantage of every owner to enter his contractors in the competition.

We feel however, that the danger exists of this progress being only temporary, and are convinced that the best and most permanent effect can only be produced by persistent effort in the same district for a series of years; the only way to encourage the majority of this class of cultivator to permanent effort is to convince him of the financial benefit he will derive through increased yield, and as it is unreasonable to expect any large or permanent increase within a year or even two, we desire to submit to the serious consideration of the Board the permanent advantage that would be gained by continuing the competition in one district for at least five years.

Attached is a return of the twenty-six competitors judged.

(Sgd.)	{	G. G. BROWN.
		D. C. PLUMMER.
		L. A. BRUNTON.

"Diego Martin and St. Ann's Districts.

CLASS II :—CONTRACTORS.

(Order.	Value of Prize.	Name.	Acreage.	District or Estate.	Ward.	Tillage.				Sanitation.			General.	(Grand Total.
						Draining.	Forking.	Manuring.	Systematic.	Total.	Preventive.	Remedial.	Systematic.	Total.
1	\$60	Sumarie	3	Green Hill Estate	Diego Martin	20	10	10	10	50	10	10	10	30
2	50	Louis Thomas	10	Champs Elysee	Maraval	18	8	10	9	45	8	8	18	87
3	30	Joseph Simeon	5	Jamson Estate	Chaguaramas	18	7	7	8	40	8	8	17	82
4	20	Gungadeen	4	Green Hill Estate	Diego Martin	16	6	8	7	35	8	8	17	76
5	15	James Johnson	4	Mon Desir	Santa Cruz	17	6	1	6	37	7	7	16	75
6	{	Emile Joseph	5	Grande Curucaye	do.	16	6	8	7	36	6	7	20	72
7		Felix Pamela	4	Paradis Terestre	do.	17	7	4	7	35	7	8	14	71
8	5	Hubert Capriata	4	Tucker Valley	Carenage	17	3	4	6	30	8	8	12	71
9		William Mitchell	4	Santa Barbara	Santa Cruz	15	6	7	7	35	7	8	16	69
10		Baichoosingh	3½	Tucker Valley	Carenage	15	4	8	7	34	5	5	13	62
11		Alfred Douglass	3	La Desenda	Santa Cruz	15	7	7	7	36	4	5	10	60
12		Pierre Louis	5	Jamson	Chaguaramas	14	3	4	4	25	4	4	14	51
13		Mathew Mark	6	Belle Vue	Carenage	15	0	3	4	22	4	6	7	44
		Victor Boiselle	3½	La Carmelita	Maraval	8	2	3	3	16	3	3	8	33

COUVA-CHAGUANAS DISTRICTS.

The Judges, Mr. A. B. Carr, a planter ; Mr. L. A. Brunton, and Mr. F. T. Farfan, the Agricultural Inspector in charge of the work during the year report as follows :—

We have the honour to report that we started judging in the Cacao Prize Competition for the Couva-Chaguanas districts on Monday, April 20, beginning at Tabaquite and completed our round of inspection on Tuesday, April 28, at California.

The programme prepared by the Inspectors was adhered to strictly—it allowed for 23 visits or an average of nearly three visits a day.

The results as adjudged by us are tabulated and appended. A careful observation of the tables will show how keenly contested the competition was. The general excellence of the work done by Contractors and by the prize winners of the Peasant Proprietor class is also shown by the very high marks obtained.

The averages of marks obtained by the prize winners in both classes have been worked out, as well as those of all entrants adjudged; their perusal is interesting and informative.

In view of the extraordinary high marks obtained even by the last of the prize winners in the contractors' class and also on account of there being a *tie* for the sixth place, we recommend that the 6th and 7th prizes be added and divided equally between the obtainers of 85 marks each, and that an 8th prize of \$5.00 be provided for the next in order of merit with 84 marks. As also the ninth contractor obtained very high marks (81) we recommend that he be given a certificate of merit.

The average percentage of marks obtained by the prize winners among the Peasant Proprietors is for *tillage* 72 per cent., for *sanitation* 84 per cent., and for *general* 86 per cent., this may be considered as very fair. In the Contractors class the following percentages were obtained by the prize winners—*tillage* 89 per cent., *sanitation* 89 per cent., and *general* 91 per cent. These we consider excellent.

That good work is being done under the Cacao Prize Competition scheme is a fact, not only amply proved by the marks obtained, but also by the fact that four of the large owners of the land in the district have provided special prizes for competition among their contractors, such prizes to be awarded irrespective as to whether the contract adjudged by your judges to be the best of those on their properties is awarded a prize in the general competition or not. The action of these gentlemen is to be highly commended and can be regarded in no other way than as a mark of appreciation of the work done and of benefits derived.

(Sgd.) { A. B. CARR.
 { L. A. BRUNTON.
 { F. T. FARFAN.

Couva and

CLASS I.—PEASANT

Order.	Name.	Nationality.	Address.
Highest possible marks			
1	Geo. L. Payson ...	Trinidadian	John William Trace, Brasso...
2	Julien Charles ...	„ (French)...	Maroral Road, Brasso Piedra..
3	Cleto M. Hospidales..	„ (Spanish)..	John William Trace, Brasso...
4	Quiterro Meharris ...	„ (Spanish)..	Caparo East Rd., Brasso Piedra
5	Bessessar & Batchia...	Indians ...	Carolina Road, Couva ...
Averages for Prize-winners			
6	Edoo ...	„ Indian ...	Chaguanas ..
7	Marques Duprey ...	Trinidadian	Lemong, Tabaquite ..
8	Frederick Aqui ...	Chinese ...	Nariva, Tabaquite ..
9	Siemungal ...	Indian ..	Caparo West Road, Caparo ...
10	Ramlogan ...	Indian ...	Sewdas Road, Carapichaima...

General averages in Peasant Proprietors Class ...

CLASS II.—

1	Edward Ford ...	Barbadian	Brasso Piedra ...
2	James Catterson ...	„	Brasso Piedra ...
3	J. M. Piemental ...	Trinidadian (Spanish)	Caparo East Rd., Brasso Piedra
4	Bernard Hector ...	„ (French)	Caparo ...
5	Podai ...	Indian ...	Chaguanas ...
6A	George Henry ...	Trinidadian	Chaguanas ...
6B	Joseph Luke ...	„ (French)	Caparo ...
7	Joseph Alexander ...	„ (Spanish)	Caparo East Rd., Brasso Piedra

Averages for Prize-winners

8	Domingo Alcai ...	Trinidadian (Spanish)	La Seiva Road, Caparo ...
9	Basilio Nordeign ...	„ (Spanish)	Caparo ...
10	Louis Maynard ...	„	Brasso-Tamana Road, Brasso...
11	Frederick Richards...	„	Brasso-Tamana Road, Brasso...
12	Joseph Belgrave ...	Barbadian	Todd's Road West ...

General averages in Contractor's Class ...

Recommended by the Judges :—1st, that the sixth and seventh prizes in the Contractors class be added and divided between George Henry and Joseph Luke, both of whom obtained 85 marks. 2nd, Joseph Alexander be given a prize of \$5 (not provided for) and that Domingo Alcai be awarded a certificate of merit.

Chaguanas Districts.**PROPRIETORS.**

Drainage.	Forking.	Manuring.	Systematic.	Total for tillage.	Preventative.	Remedial	Systematic.	Total Sanitation.	General.	Grand Total.	Prizes.
20	10	10	10	50	10	10	10	30	20	100	
18	7	6	8	39	8	10	9	27	19	85	\$90.00.
17	8	8	8	41	8	8	9	25	18	84	65.00
14	8	5	7	34	9	9	9	27	18	79	45.00
14	6	8	7	35	9	9	9	27	15	77	30.00
16	4	6	6	32	6	7	7	20	16	68	20.00
15.8	6.6	6.6	7.2	36.2	8.	8.6	8.6	25.2	17.2	78.6	
17	4	5	6	32	6	4	5	15	15	62	
13	4	4	5	26	7	8	7	22	11	59	
12	5	6	6	29	5	3	4	12	11	52	
18	0	2	4	24	4	3	4	11	11	46	
18	5	3	3	19	4	4	4	12	9	40	
14.7	5.1	5.3	6.	31.1	6.6	6.5	6.7	19.8	14.3	65.2	
CONTRACTORS.											
20	9	9	10	48	10	10	10	30	19	97	\$60.00
19	8	9	9	45	9	10	10	29	19	93	50.00
20	8	8	9	45	9	9	10	28	19	92	30.00
18	9	9	9	45	8	9	9	26	19	90	20.00
20	8	9	9	46	7	9	9	25	18	89	15.00
18	9	9	9	45	7	8	8	23	17	85	7.50
19	7	8	9	43	8	8	8	24	18	85	7.50
18	7	7	8	40	8	9	9	26	18	84	5.00
19.	8.1	8.5	9.0	44.6	8.2	9	9.1	26.3	18.3	89.3	
18	7	7	8	40	7	8	8	23	18	81	Certificate.
18	5	6	7	36	7	8	8	23	18	77	
13	4	7	7	31	9	9	9	27	18	76	
15	5	6	7	33	8	8	8	24	15	72	
19	6	8	8	41	5	4	5	14	16	71	
16.0	7.0	7.8	8.3	41.3	7.8	8.3	8.5	24.7	17.8	84.0	

Spraying on Small Holdings.—An account of the spraying demonstrations on small holdings was given in the *Bulletin* XII, November, 1913, p. 165. Mr. J. B. Rorer, the Mycologist reported to the May meeting of the Board of Agriculture as follows :—

I have the complete returns from the cacao spraying which has been done on a small proprietor's place in the Diego Martin district. The trees were sprayed last fall and the pickings up to date show that about four more sound pods per tree have been harvested from the sprayed trees. Having these encouraging results I intend to start one or two more spraying demonstrations for peasant proprietors; this work will be done in the same districts in which the Prize Competition is being carried on, for in this way the Agricultural Instructor can see that the people attend the demonstrations and that proper records of the pickings are kept. During my absence last year, Mr. Brunton looked after the two demonstrations which were in his district, and I would like to take this opportunity of thanking him for the thorough way in which the spraying was done, and the careful records which he has kept of the different pickings.

SUGAR.

MANURIAL EXPERIMENTS AND NEW VARIETIES.

At the May meeting of the Board of Agriculture Mr. J. de Verteuil, Superintendent of Field Experiments made the following preliminary report on the estate manurial experiments and on the analysis of the new Barbados varieties in the River Estate nursery :—

ESTATE MANURIAL EXPERIMENTS.

The cane plots at Brechin Castle were reaped between March 16 and 25, and at Esperanza on April 6, 7 and 8. Each plot is composed of eight smaller plots situated over different parts of the experiment block, in order to try and avoid irregularities of the soil.

At Brechin Castle the field under experiment is planted with B. 156 and the yield from the different plots varies from 43·57 to 48·97 tons of cane per acre. The control plot gave 43·57 tons per acre, whereas 48·97 tons of cane per acre were obtained from plot 1 which received 45lb. nitrogen as calcium nitrate, 40lb. phosphates as dissolved bones, and 28lb. potash as sulphate of potash. The next best plot was No. 4 with 47·45 tons of cane per acre. This plot received the same quantity of manures as No. 1, but the nitrogen was supplied from sulphate of ammonia.

Two other blocks in this field of the same size as the eight experiment plots added together and which were treated with the estate mixture gave 46·06 and 42·18 tons of cane per acre respectively.

At Esperanza, the cane planted is B. 147 and the yield varies from 16·34 to 24·06 tons of cane per acre. Here again, plot 1 is the best and next to it comes the control plot with a yield of 23·15 tons per acre.

Two blocks of identically the same size, as the piece under experiment, were cut and weighed separately. They may be considered as control plots, as they were not treated with any artificial manures. They gave 17·79 and 15·43 tons of cane per acre.

When the results from Malgretoute have been received a complete report on these experiments will be prepared.

ANALYSIS OF PLANT CANES ABOUT 12½ MONTHS OLD FROM THE NURSERY AT "RIVER ESTATE.

Cane.	Brix.	Sucrose per cent.	Glucose per cent.	Quotient of Purity.	Lb. Sucrose per gallon.
B. 6308	19·8	17·66	0·64	89·2	1,911
B. 6835	19·5	17·35	0·60	89·0	1,875
B. 6388	19·1	17·04	0·90	89·2	1,839
B. 6450	18·7	16·58	0·98	88·6	1,786
B. 4578	18·8	15·51	1·73	82·5	1,672
B. 3390	18·4	15·44	1·41	83·9	1,661
B. 1753	18·2	15·07	1·67	82·8	1,620
B. 16536	17·8	14·85	1·50	83·4	1,594
B. 7169	18·2	14·53	1·96	79·8	1,562
B. 4934	16·8	14·42	1·07	85·8	1,542
B. 16832	16·9	13·20	2·14	78·1	1,412

COCONUTS.

THE RAT AS A COCONUT PEST.

The following note by Mr. H. C. Pratt is reproduced from the *Agricultural Bulletin of The Federated Malay States*, Vol. 11, February, 1914, pp. 192-3:—

The position of priority as a really serious pest to young coconuts in the Malay States must be given to rats. They have caused immense damage in several districts, completely destroying as much as 2,000 acres in one locality. They are not constant in their attack. At certain times of the year they invade young fields in immense numbers and working at night nibble the base of the trees, eventually, eating out the heart, leaving a hole about 2 inches in diameter. The young plant naturally dies. Several remedies were tried and that which is the most satisfactory is the protection of each individual tree. Originally the expense of this method was its one drawback. With kerosene tins it would cost \$17 per acre. With sheets of zinc the cost was reduced to about \$12 per acre. Several designs were tried in order to reduce the cost and it is now possible to prevent the ravages of this destructive animal at a total cost of \$5 per acre. Considering the immense damage which rats cause this may be regarded as a nominal cost, although it may be possible still further to reduce it. All estates having young coconuts, *i.e.*, those recently planted out, and where rats have previously demonstrated their ability to devastate large tracts of land should, as a matter of insurance, be prepared to spend this amount on protecting their recently planted areas. It is quite apparent that non-protected areas in some districts are very liable to be destroyed and should this happen the loss involved includes the following:—

- 1 year lost.
- 1 year's weeding.
- Re-lining.
- Re-planting.
- Purchase of nuts.

The following method for the protection of young trees will prove satisfactory. Out of a piece of zinc 18 inches long and 12 inches wide, an arch is cut at the middle of the longer edge, measuring approximately 7 inches wide at the base and 5 inches high.

The nut itself fits into this arch and by drawing the tin round the tree a cylinder about five inches in diameter is formed enclosing the young tree which practically fills the cylinder. The base of the cylinder on either side of the arch is buried about three inches in the ground thus enabling the top of the arch to fit tightly over the upper part of the nut. No rat can harm a young plant protected in this way, for if access is obtained by burrowing there is no room for the rat to work within the enclosure.

Older trees can be dealt with more easily and by the cheaper system of attaching a ring of tin to the trunk with the upper edge turned down. It would not be feasible on account of the expense to enclose older trees. Although it is probable that where the rats are in excessive numbers no trees would be really immune; there can be no doubt that it is the

younger ones, in fact those recently planted, that require guards. After they are a year old they are not at present often damaged and the guards above described will protect them for this necessary period.

Spraying for Bud Rot.—An experiment to ascertain whether spraying with Bordeaux Mixture is of service in controlling bud rot has been in progress for some time at Roxburgh, Tobago. Another is now to be started at Toco. At the May meeting of the Board of Agriculture, Mr. J. B. Rorer, the Mycologist said:—

Since the last meeting, I have spent two weeks in the field in the north-eastern district of Trinidad. Coconut bud-rot was found at several places around Matura and Toco; at the latter place a spraying experiment has been started similar to the one which is being carried out at Roxburgh, Tobago, for the purpose of determining whether or not bud-rot can be controlled by the use of Bordeaux mixture. On two different estates at Toco a certain number of trees have been sprayed, and a record will be kept which will show whether or not the disease can be controlled in this way. Another application of Bordeaux mixture will be made early in July and a third application towards the end of the year.

Farasol Ants.—The following observation was noted by Mr. J. de Verteuil at the May meeting of the Board of Agriculture:—

When in Tobago a couple of months ago, I inspected all the experiment plots. At King's Bay the coconut plots were being picked and one of the pickers brought down a dried immature nut containing a parasol ants nest filled with inhabitants and the fungus on which the young "bachachs" feed. This is rather an unusual occurrence, which is worth while recording.

LIVE STOCK.

BENGAL BEANS, A NEW FODDER.

By HERBERT S. SHREWSBURY, F.I.C., F.C.S.,
Acting Government Analyst.

A sample described as Bengal beans was recently submitted to the Department with a request for information as to its suitability for fodder, particularly with regard to its possible toxic properties. The beans were oval and rather flat, about 16x10x5 m.m., with black shining testas, and a white oblong crateriform hilum about 7 m.m. in length.

IDENTITY.

I am indebted to the Acting Director of Agriculture for the following botanical notes on the sample. Apparently Bengal beans were originally described as *Mucuna pruriens* var. *utilis*, or *Mucuna utilis* notwithstanding the great differences between *Mucuna pruriens* and its supposed cultivated varieties.

The group has been investigated by Messrs. Piper and Tracy of the United States Department of Agriculture and their results published in *The Florida Velvet Bean and Related Plants*—(Bulletin No. 179. Bureau of Plant Industry.)

Comparison with their descriptions indicates that the beans sent are to be referred to *Stizolobium aterrimum*, but there still seems to be a doubt as to whether this name is not a synonym for *Stizolobium utile*, the *Mucuna utilis* of Wallich, which has been cultivated extensively in Mauritius and Tasmania as a table vegetable and as a fodder for cattle.

REASONS FOR SUSPECTING TOXIC QUALITIES.

Considering that the beans of *Mucuna pruriens* are a violent aphrodisiac, and that *Stizolobium niveum*, a closely related plant to *Stizolobium arterrimum* caused vomiting and purging when Professor P. H. Rolfs and five other persons partook experimentally of its seeds, prepared as baked beans, it will be seen that there are good grounds for suspecting the sample of toxic properties. I am also informed that the leaves of the vine have poisoned cattle in Barbados. Mr. John R. Bovell of Barbados has stated that he has never known *Stizolobium arterrimum* to be used for fodder or as human food.

EXAMINATION FOR TOXIC PROPERTIES.

The sample was searched for cyanogenetic glucosides by the method of Henry and Auld. No evidence was found of their presence although 176 grammes of the whole meal were used for the determination. With this quantity as little as .0002 per cent. of hydrocyanic acid would have been estimated. No evidence was found of other poisonous glucosides, saponins, fats, alkaloides, vegetable ptomaines or toxalbumins. Several feeding experiments with guinea pigs, in which the animals were fed with liberal quantities of the whole meal, the ground testas of the beans, the bean flour deprived of the testas, and various solvent extracts of the whole meal, gave entirely negative results. There was no indication of any toxic

effect, the guinea pigs exhibiting no abnormal symptoms, and their excretions continuing perfectly normal in character.

TASTE, ODOUR AND APPEARANCE OF FODDER.

The whole meal from the beans has a clean and pleasant appearance. The interior of the bean, which is easily ground, forms a very pale yellow powder, which is mottled by the shining fragments of the black testas. The taste and odour are pleasant and closely resemble that of pea meal.

NUTRITIVE VALUE.

The table below presents comparative analyses of the whole meal with that of other dried beans.

Kind of Bean.	PERCENTAGE OF						
	Carbo- hydrates.	Proteins.	Water.	Crude fibre.	Ash.	Fat.	Feeding units.
Sample in question ...	44.3	29.8	12.0	6.2	4.2	3.5	127
<i>Phaseolus vulgaris</i> (French or Kidney bean) ...	52.7	23.1	13.6	4.8	3.5	2.3	116
* <i>Phaseolus lunatus</i> (Java or Lima bean) ...	67.1†	15.9	11.1	...	4.1	1.8	111
<i>Vicia Faba</i> (Field or horse bean) ...	49.3	23.9	14.5	7.5	3.2	1.6	113
<i>Soja hispida</i> (Soy or Soja bean) ...	30.2	33.2	10.0	4.4	4.7	17.5	157

It will be seen that the sample is somewhat superior in feeding value to French, Lima or Java beans and that like these beans its nutritive properties are principally due to the high content of carbohydrates and proteins. Owing chiefly to its low percentage of fat, its value is considerably less than that of Soy beans.

TENTATIVE USE AS FODDER.

Caution is recommended in the use of these beans as a fodder, until their merits have been more firmly established. Tentative feeding experiments should first be tried on animals of small value. Apparently innocuous fodders, *e.g.* beet, have been found to cause boils and other illness in cattle subjected to a too prolonged diet.

The Department has since been informed that an experiment is being made on an old ox and mule on the estate from which the sample was received to test the result of using the beans as a food stuff.

* Java beans contain a cyanogenetic glucoside and their inclusion in the table not intended to indicate their desirability as a fodder.

† Includes crude fibre.

MONGOOSE.

THE MONGOOSE IN TRINIDAD AND METHODS OF DESTROYING IT.*

By F. W. URICH, F.E.S. C.M.Z.S.

Entomologist to the Board of Agriculture.

LETTER OF TRANSMITTAL.

TO HIS EXCELLENCY THE PRESIDENT

AND MEMBERS OF THE BOARD OF AGRICULTURE.

GENTLEMEN:

In accordance with the recommendations of the Board of January, 17, 1913 I continued the experiments with traps and poisons and they have shown that mongoose can be trapped and poisoned, and that when a district has been properly worked it takes a few months before re-infestation occurs. On Esperanza Estate 334 mongoose were caught during the period from September 1912 to March 1914, traps being used in the canefields and traces only. In the Laventille and Maraval districts I employed two men for trapping. One worked from April to December 1913 in Maraval, Santa Cruz and Debé and during the time accounted for 348 animals; another trapped from June to December in Laventille and San Juan, and got rid of 112 mongoose.

The poisoning experiments have not been as satisfactory although they appear to yield better results as far as numbers are concerned. The trouble has been that up to now it has not been possible to recover any of the poisoned mongoose, although there are unmistakable signs that the prepared bait has been taken by them and not by other animals. There is no reason why mongoose should not be treated like any other agricultural pest; I therefore recommend that an active campaign be started as follows:—

1. That the Board of Agriculture issue the Circular now submitted.
2. That the co-operation of the Agricultural and District Agricultural Societies be secured to urge all the inhabitants in infested districts to destroy mongoose.
3. That suitable placards be posted in the country districts calling attention to the mongoose pest and giving short directions for dealing with them.
4. That traps be supplied at a nominal cost.

F. W. URICH,
Entomologist.

BOARD OF AGRICULTURE,
April 16, 1914.

* Issued June 19, 1914 as *Circular No. 12* of the Board of Agriculture.

INTRODUCTION.

THE Mongoose *Herpestes mungo* was introduced into Trinidad about the year 1870 by a sugar estate in the Naparimas for the purpose of controlling rats which were pests in that district. The animals arrived from India in a coolie ship and some escaped in Port-of-Spain. There is no authentic record of how many animals reached the Naparimas, but evidently the mongoose did not thrive there as up to now comparatively few have been reported from that district. From 1870 to 1898 little was heard of the mongoose, but there is reason to believe that during those 28 years importations took place. About the year 1898 the mongoose originally considered beneficial in Jamaica, where it had been introduced in 1872, became a great pest there through its omnivorous habits. The first occasion on which attention was paid to the presence of mongoose in Trinidad was at a meeting of the Agricultural Society in 1898 when the following is recorded in the minutes.* "In regard to a letter addressed to the Colonial Secretary by the Field Naturalists' Club drawing attention to the objections to the introduction of the mongoose into the colony and to a further letter from Mr. Eugene Lange stating that he had introduced and let loose on his estate at Santa Cruz five specimens of the Mongoose. It was resolved: "That in the opinion of this Society, the importation of the Mongoose should be absolutely prohibited, and that this resolution be forwarded to the Colonial Secretary for the information of His Excellency the Governor."

In 1902 Mr. John McInroy Manager of St. Augustine Estate reported the existence of mongoose there and suggested the offer of a reward for the carcase of each mongoose killed.** The Government adopted this suggestion and the system of paying for the destruction of the mongoose was started by the Government in April 1902. In 1907† it was reported that in spite of rewards mongoose were still on the increase. In March 1912 payments for carcasses were suspended. In May 1912 the Board of Agriculture decided that I should carry out experiments in connection with the destruction of mongoose. In December 1912 I submitted a short report giving the results of the different kinds of traps experimented with, the baits used, and the poison tried.

To Messrs. C. Connell and W. Knaggs I am indebted for much assistance in connection with the trapping experiments.

NATURAL HISTORY AND HABITS.

The original home of the Trinidad Mongoose appears to be India; there, according to Dr. Blandford it is found in hedgerows, thickets, groves of trees, cultivated fields, banks of streams, and broken bushy ground, but not commonly in dense forests. It is often found about houses and lives and breeds in holes dug by itself. Very little appears to be known about its breeding habits. It is often seen in pairs and the young are three or four in number and produced in the spring. In Trinidad Mongoose frequent principally localities covered with second growth, on or near villages and estates. They are also found on Cacao and sugar

* *Proceedings Agricultural Society of Trinidad*, Vol. III., page 197.

** *Proceedings Agricultural Society of Trinidad*, Vol. V., page 25.

† *Proceedings Agricultural Society of Trinidad*, Vol. VII., page 70.

estates, in the thickets bordering the cacao, and in the tall grass and bush of abandoned sugar cane fields, also among the high canes. None have been observed in forests far from cultivated lands.

In localities frequented by mongoose regular runs similar to those made by rats (see Plate II.) are to be seen. They are made by the mongoose who confine themselves to one locality and cover the same ground in their daily hunting expeditions. The mongoose is diurnal in its habits and is on the move principally in the morning up to 10 and 11, and in the afternoon from 2 to 5. During the rainy season the mongoose is found on high lands not liable to be damp, but in dry weather it occurs everywhere. During the dry season its struggle for existence appears to be greater, due no doubt to the scarcity of insects, crabs and frogs, and it is this time that the raids on poultry are most frequent. Its food consists of lizards, rats, crabs, eggs, and young of ground nesting birds and large insects such as grasshoppers, beetles, etc., found on the ground. The mongoose cannot climb, so that tree rats and many of our insectivorous birds escape.

BREEDING.

The time of breeding appears to be irregular and it would look as if it were continuous. Pregnant females have been caught in April, November and December, and young animals have been taken in July and September. Two to three young are produced at a time. It is not known whether there is more than one litter a year. No breeding in confinement was tried.

DESTRUCTIVENESS.

The Mongoose is most destructive by its omnivorous habits. In Jamaica it has been known to destroy young pigs, kids, lambs, kittens, puppies, poultry, birds of all kinds nesting near or on the ground, ground lizards, snakes, frogs, turtles' eggs, and land crabs. In Trinidad it is chiefly as a destroyer of eggs and poultry that the mongoose attracts more attention, but it does incalculable harm to agriculture in general by destroying harmless and useful snakes, ground lizards, tick birds, frogs and toads. Although some insects are included in its diet its usefulness in this direction is overbalanced by its destruction of their natural enemies.

DISTRIBUTION IN TRINIDAD.

The principal haunts of the Mongoose are the Western and North-western parts of Trinidad comprising the Wards of St. Ann's and Diego Martin, Tacarigua, Couva, Chaguanas and Arima. These districts are heavily infested. The animals are however spreading eastwards and southwards and are now to be found, not in very large numbers, in Savana Grande, Manzanilla, Cumuto, Montserrat and Naparima. None have so far been recorded from Cedros, and Mayaro and the Northern coast of the Island. There are no mongoose in Tobago and their importation into that Island should never be permitted.

NATURAL ENEMIES AND DISEASES.

So far no natural enemies of the mongoose have been recorded from Trinidad, nor have at any time animals been observed to be suffering from

any infectious disease. It is possible that very young animals are destroyed by hunting ants (*Eciton* sp.)

DESTRUCTION.

The means of destruction at our disposal are hunting with dogs trained for the purpose, trapping, poisoning, and payment of rewards for animals destroyed.

HUNTING WITH DOGS.

In some districts, and at the time the Government was paying a premium, dogs were trained to hunt mongoose. This method is not, in my opinion as good as trapping, as the mongoose can put up a good fight and is very cunning.

TRAPPING.

By taking certain precautions mongoose can be easily trapped. Any good make of jaw trap can be used but the model figured on Plate I. has yielded the best results and is to be recommended. It is simple in construction and by placing the trigger release to the right or left, it can be made to go off by pulling or pushing. By having few projections it can be concealed very easily. Native fly traps can be used but they are not superior to the proper kind of iron trap.

DIRECTIONS FOR SETTING TRAPS.

In places where mongoose are common look for their runs which are similar to those made by rats. On Plate II. figure 4 will be found an illustration of one of the runs. When no runs exist near fowl houses, the traps may be set near by, and when covered up made to look like a nest. Before setting the traps dig a shallow hole just deep enough to take the trap so that it remains just below the level of the ground (*See* Plate I. figure 1). The trap must be placed in the middle of the run and in such a way that the centre spring is parallel with the sides of the run. After attaching the trap by means of the chain to a stake or a tree near by, cover up lightly with loose earth and leaves and only allow the bait to show, as represented on Plate I. figure 2.

BAITS.

As bait, use smoked herring, the fat part of salt pork, shrimps, fish entrails, heads of fowls and eggs. All baits are more attractive when in a state of decomposition. In the trapping experiments undertaken dummy eggs have been very successful. They can be made by filling an egg shell with plaster of paris. The hole on the egg shell is made on the side and should be large enough to allow liquid plaster of paris to run in freely. When the plaster has set, a small hole is bored through the egg, and wire or string passed through for tying it on to the trap. In connection with all baits it is of the most importance to remove all traces of odours resulting from handling them, and for this purpose rotten eggs are used. The contents of one or two rotten eggs may be kept in a bottle for use. After setting traps, apply rotten egg by means of a brush or feather to the bait. Dummy eggs especially should always be well painted over, as otherwise they are not attractive.

POISONING.

In using poisons the greatest care is to be exercised to guard against accidents of all kinds, not only to domestic animals, but to human beings

also. With reasonable precautions there need not be any risk in the use of poisons. Sulphate of strychnine is the poison that is best for use, not only is it effective but it is also economical in use. Strychnine has been used effectively both dry and in solution. The dry method is simpler in application and consists in filling 2 grain gelatine capsules loosely with the dry crystals and inserting the capsules into a piece of smoked herring or fat of salt pork, care being taken to imbed the capsule well into the bait. The pieces of poisoned bait are placed in bamboo joints, large enough to admit a mongoose, in the runs and when on the ground should be painted over with rotten egg to take away all odour of handling. The method of using strychnine in solution consists in dissolving 1 ounce of the crystals in 48 ounces of water and by means of a hypodermic syringe injecting eggs and shrimps with the solution.

BEST SEASON FOR TRAPPING.

Mongoose can be taken at all times of the year, but dry months appear to be the time when they are most ravenous. On reference to Table II it will be seen that more were caught in the dry months of the year.

PAYING FOR CARCASSES.

This system is in use on some sugar estates where good supervision can be exercised. The labourers of the estate either trap or hunt the mongoose with trained dogs. The system of paying by the Government was not a success in keeping down the pest. Table III shows the number of mongooses destroyed and paid for from 1902 to 1913.

RESULTS OF CONTROL.

In localities where mongoose are caught regularly it has been observed that ground lizards and ground doves have increased. After trapping has been carried out regularly in one locality mongoose ceased to be troublesome for several months, but owing to the lack of co-operation the freed districts are reinfested from adjoining lands.

TABLE I.

MONGOOSE CAUGHT AT ESPERANZA ESTATE FROM 1ST SEPTEMBER, 1912,
TO 21ST MARCH, 1914.—USING 12 TRAPS.

Fortnight Ending.	Males.	Females.	Total.	Fortnight Ending.	Males.	Females.	Total.
7 Sept., 1912	6	4	10	Brought forward.	70	80	150
21 " "	5	6	11	28 June, 1913	4	9	13
5 Oct., "	1	5	6	12 July, "	5	3	8
19 " "	1	5	6	26 " "	3	3	6
2 Nov., "	7	6	13	9 August "	6	2	8
16 " "	2	1	3	23 " "	9	11	20
30 " "	4	5	9	6 Sept., "	7	10	17
14 Dec., "	0	2	2	20 " "	6	8	14
28 " "	3	4	7	4 Oct., "	8	9	17
11 Jan., 1913	1	2	3	18 " "	5	6	11
25 " "	1	1	2	1 Nov., "	1	3	4
8 Feby., "	1	4	5	15 " "	2	1	3
22 " "	1	2	3	29 " "	0	1	1
8 March, "	4	2	6	13 Dec., "	2	0	2
22 " "	7	7	14				
5 April, "	6	3	9	10 Jan., 1914	3	3	6
19 " "	9	9	18	24 " "	6	4	10
3 May, "	5	6	11	7 Feby., "	11	7	18
17 " "	4	4	8	21 " "	2	8	10
31 " "	1	2	3	7 March, "	4	7	11
14 June, "	1	9	1	21 " "	1	4	5
	70	80	150	Totals ...	155	179	334

TABLE II.—MONGOOSE CAUGHT WITH 12 AND 18 TRAPS.

Date.	No.	Total.	Locality.	Remarks.
April 2 to 5...	7	...	Maraval	...
" 7 " 12...	11			Traps set in the open in runs.
" 14 " 19...	15			
" 21 " 26...	7			12 Traps used.
" 28 " May 2...	3	43		
May 4 to 10...	8	...	Fort George.	
" 12 " 17...	6			
" 19 " 24...	5			
" 26 " 31...	4	23		
June 2 to 7...	8	...	Maraval.	
" 9 " 14...	7			
" 16 " 21...	12			
" 23 " 28...	4			
" 30 " July 5...	5	36		
July 7 to 12...	9	...	Maraval.	
" 14 " 19...	10			
" 21 " 26...	11			
" 28 " Aug. 1...	4	34		
Aug. 3 to 31...	92	92	Santa Cruz	... 18 Traps used.
Sept. 1 " 7...	1	...	Dibé.	
" 8 " 14...	1			
" 15 " 21...	2			
" 28 " Oct. 5...	0	4	Dibé	... Traps concealed under rubbish and logs of wood. 12 Traps used.
Oct. 6 to 12...	4	...		
" 18 " 19...	2			
" 26 " 30...	3	9		
Nov. 2 to 9...	13			
" 10 " 16...	14			
" 17 " 23...	9			
" 24 " 30...	9	45		
Dec. 1 to 7...	14	...	Dibé	... Traps set in the open in runs.
" 8 " 14...	15			
" 15 " 21...	12			
" 22 " 28...	15			
" 29 " 31...	6	62		12 traps used.
Total ..		348		

TABLE II.—MONGOOSE CAUGHT WITH 12 AND 18 TRAPS. -Continued.

Date.			No.	Total.	Locality.	Remarks.
June 4 to	14...	5	...		Laventille ...	12 Traps used in the open in runs.
" 16 "	21...	8				
" 28 "	28...	1	9			
July 2 to	5...	3	...		San Juan.	
" 7 "	12...	5				
" 14 "	20...	6				
" 21 "	26...	2	16			
Sept. 1 to	27...	0				
" 28 "	30...	1	1		Laventille ...	12 Traps used under cover of logs of wood.
Oct. 1 to	5...	2				
" 6 "	25...	0				
" 26 "	31...	1	3			
Nov. 2 to	9...	9	...			12 Traps used in the open.
" 10 "	16...	11	...			
" 19 "	23...	9	...			
" 24 "	30...	12	41			
Dec. 1 to	...	5	...		Laventille and San Juan.	
" 8 "	14...	12				
" 15 "	21...	9				
" 22 "	28...	10				
" 29 "	31...	6	42			
Total	...	...	112			

TABLE III.

TOTAL NUMBER OF THE MONGOOSE DESTROYED FROM APRIL, 1902 TO FEBRUARY 1913, AND THE AMOUNT EXPENDED FOR THE PURPOSE: *

Ward.				Number.	Cost.		
					£	s.	d.
Savana Grande	...	...	...	74	7	4	6
Manzanilla	...	...	...	541	54	15	3
St. Ann's and Diego Martin	...	...	...	3,143	395	7	6
Tacarigua	...	...	...	13,925	1,851	14	0
Cedros...	...	...	...	Nil	...		
Mayaro	...	...	...	"	...
Couva and Chaguanas (approx.)	...	...	...	8,200	995	0	0
Toco	...	...	...	3	0	6	0
Montserrat	...	...	...	214	26	9	6
Oropuche and La Brea	...	...	...	Nil	...		
Naparima	...	...	...	43	5	7	6
Arima	...	...	...	4,752	614	12	1½
Total	...	...	...	30,895	£3,950	16	4½

Note :—Tobago not included. The system of paying for the destruction of the Mongoose was commenced by the Government, on the advice of The Agricultural Society in April, 1902.

Proceedings Agricultural Society of Trinidad and Tobago—Vol. XIII page 131.

PLATE I.

FIG. 1—Trap in small pit baited with dummy egg ready to be covered over with leaves and loose earth.

FIG. 2—Trap covered only egg showing.

FIG. 3—Mongoose in trap. When properly set *i.e.* jaws of trap parallel to sides of run the mongoose is generally caught in this manner.



FIG. 1. Method of setting trap.



FIG. 2. Trap when set.



FIG. 3. Mongoose in trap.

PLATE II.

FIG. 4—Haunt of mongoose in the dry season in a thicket near Port-of-Spain. The cutlass and helmet show relative size of run.

FIG. 5—Run of mongoose. Arrow indicates where trap is set, only the dummy egg visible.

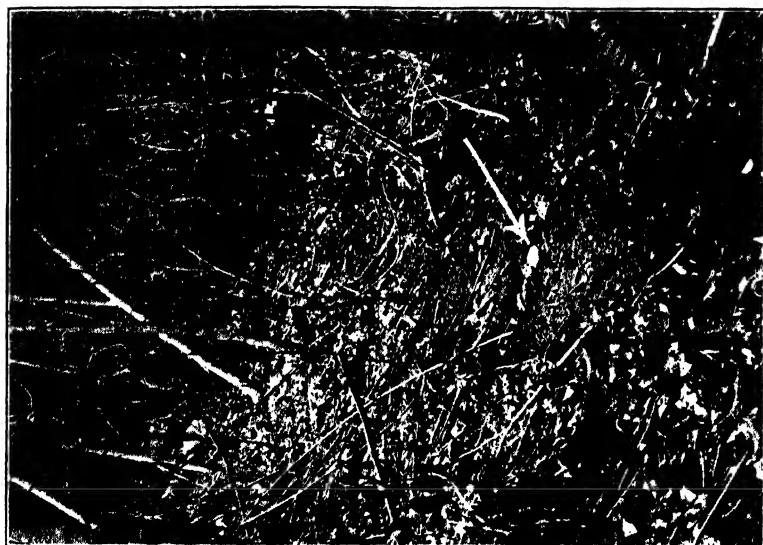


FIG. 5. Trap as set in run of mongoose.



FIG. 4. Favorite haunt of mongoose.

PLANT DISEASES AND PESTS.

Notes on Prevalent Pests.—At the meeting in May of the Board of Agriculture the Entomologist contributed the following observation regarding insect pests which usually became abundant during the early part of the rainy season —

There are not many insect pests about now on account of the dry weather. In some localities cacao beetles are being caught in numbers. With the advent of the rains however, things will change, the æstivating eggs of the froghoppers and grasshoppers will hatch and caterpillars of different species may become numerous. It is well that all concerned get their apparatus and insecticides ready to meet contingencies. The following are some of the insects that may appear one or two months after the rain:—On sugar cane, froghoppers, striped grass loopers and mothborers in young plants and ratoons; on corn, bud worms and mothborers; on coconuts, coconut butterflies. At Icacos and Cedros grasshoppers in the hopping stage. Caterpillars and grasshoppers are controlled by spraying the vegetation with arsenate of lead or Paris green. Mothborers can be kept under by the use of trap lights, cutting out dead hearts and collecting egg masses; in connection with the latter due regard should be paid to the parasitized masses which are of a black colour and from which the parasites should be allowed to escape. On cacao estates there will be an increase of leaf-eating beetles and of caterpillars, and on places where spraying is done, it would be advisable to add arsenate of lead to the Bordeaux mixture at the rate of four pounds to every fifty gallons of mixture.

EXPERIMENT WORK.

SCHEME OF EXPERIMENT WORK 1914-15.

As recorded on page 136 an Experiment Committee of the Board of Agriculture has been formed to be an advisory body on experimental work carried out by the Department of Agriculture and the officers of the Board with the object of securing greater co-operation between planters and agricultural officers. The following is the report of the Committee.—*Adopted by the Board of Agriculture in June.*

Meetings of the Experiments Committee were held on Friday, May 22, 1914 :

- A. The Sugar Section at 9.30 a.m. Present : The Acting Director of Agriculture (Vice-President) in the chair, Acting Assistant Director of Agriculture, Hons. J. L. Moodie, W. G. Kay, Messrs. J. B. Rorer (Mycologist) and A. Devenish (Secretary).
- B. The Cacao Section at 1 p.m. Present : The Acting Director of Agriculture (Vice-President) in the chair, Acting Assistant Director of Agriculture, Hon. J. L. Moodie, Messrs. J. d'Abadie, A. B. Carr, W. C. Jardine, L. de Verteuil, J. B. Rorer (Mycologist), J. C. Augustus (Superintendent River Estate) and A. Devenish (Secretary).

The Minutes of the meeting of May 15, were read and confirmed.

The following items on the agenda were dealt with, in connection with Experimental work for 1914-15 and it was agreed :—

SUGAR CANE.

1. That the present manurial experiments on ratoon canes be continued, and that a circular be sent to managers of estates enquiring whether they would be willing to carry out at their own expense a new set of manurial experiments on their estates under the general supervision of Mr. J. de Verteuil (Superintendent of Field Experiments).

2. That tests of varieties of canes be made on heavy and light soils to ascertain the kinds best suited to each soil and their relative times of maturity. That the following estates be asked to give facilities for such a series of experiments :—Caroni, La Fortunée, Brechin Castle, Esperanza, and Aranguez, the tests to be on black and red soils at La Fortunée and heavy and light soils on the other estates.

That if possible 10 varieties of canes be tried, including Bourbon in each set, planted 5 x 8 feet, single plants, and fall planting only ; each plot to be not less than $\frac{1}{2}$ acre but preferably one acre.

The juice of the canes to be tested at 15 months and thence monthly.

3. That the Sugar-cane Nursery at present at River estate be discontinued owing to the presence of moth-borer in the district due to corn cultivation, and transferred to St. Augustine Estate, provided the Sugar Committee concurs after its visit of inspection on the 29th instant.*

* The Sugar Committee has since visited the Nursery and agreed to this proposal.—W.G.F.

4. That it is advisable that work on the hybridizing and rearing of Sugar-cane seedlings should be undertaken. The Acting Director of Agriculture undertook to submit proposals at a later date.

5. That the Mycologist continue the study of the fungoid diseases of Sugar-cane, with the view to the preparation of a bulletin on the subject.

6. That the culture and distribution of the Green muscardine fungus against Froghoppers be continued.

7. That the Entomologist continue the Froghopper experiments on Esperanza Estate.

8. That the Entomologist inaugurate experiments relating to the effect of the small moth-borer on the juice of affected canes.

CACAO.

9. That the existing manurial experiments be continued.

10. That before any new series are started on the plots of which the "Natural Yield" is now being recorded the soils be analysed and subsequently after about four years manurial treatment.

11. That in future the results from the manurial experiments should be recorded graphically as well as in tabular form.

12. That the following experiment plots be started at River Estate on the area now occupied by the Sugar-cane Nursery if this be discontinued. The object of the experiment being to test budding and grafting on an estate scale.

Ordinary shade	...	{	A.—1 acre, cacao budded at stake.
			B.—1 " " " in Nursery.
			C.—1 " Seedlings.
			D.—1 " cacao grafted.
No permanent shade..	{	{	E.—1 " cacao budded at stake.
			F.—1 " cacao Seedlings.

The seeds for C and F to be from the same selected trees which will supply the bud or graftwood for the other plots. Stocks to be Calabacillo in A, B, D and E sown either in Nursery or at stake in the same season in which the seeds for C and F are sown.

Planting distance to be 12 x 12.

13. That it would be desirable if somewhat similar experiments be made on virgin cacao soil in other parts of the Colony.

The budding and grafting of the plants to be undertaken by the Department of Agriculture and the cost defrayed by the Board; all other expenditure to be paid by the estate.

14. That experiments be made on a large scale to test:—

(A.) Forking *v.* Non-forking.

(B.) Weeding *v.* Cutlassing.

15. That the Mycologist continue the spraying experiments at Santa Estella Estate, Sangre Grande; start another experiment on Mr. Carr's estate, and test the new power sprayer at Mr. A. Maingot's Estate.

16. That the Mycologist extend spraying demonstrations amongst small proprietors.

17. That the Mycologist and Entomologist prepare a revised Circular on Cacao diseases.

18. That the Mycologist proceed with investigation on the yeasts, &c., concerned in cacao fermentation.

19. That the Entomologist continue experiments with Cacao beetles and thrips.

COCONUTS.

20. That present manurial experiments be continued.

21. That spraying experiments at Roxboro and Toco be continued.

CASSAVA.

22. That the following series of experiments to test varieties and planting distances for cassava be made at St. Augustine Estate.

DISTANCE PLANTING.

Each section to be 50 feet along each bed—Two sections—one plot of approximately $\frac{1}{8}$ acre—To be planted with *middle plants* in June, 3 days before full moon. Slips to be cut two or three days before planting, heaped together and covered with grass.

1.	Variety No. 1	planted	2½ ft. x 2½ ft.	=6,969 plants	per acre.
2.	" " " "	3 "	x 3 "	=4,840	" " "
3.	" " " "	4 "	x 4 "	=2,722	" " "
4.	" " " "	5 "	x 5 "	=1,742	" " "
*5.	" " " "	4 "	x 4 "	planted say 10 days before full moon.	
†6.	" " " "	4 "	x 4 "	" " 7 " after " "	
7.	" " " "	3 "	x 3 "	top plants.	
8.	" " " "	3 "	x 3 "	bottom plants.	
9.	" " 2 "	4 "	x 4 "		
10.	" " " "	3 "	x 3 "		
11.	" " 3 "	4 "	x 4 "		
12.	" " " "	3 "	x 3 "		
13.	" " 4 "	4 "	x 4 "		
14.	" " " "	3 "	x 3 "		
15.	" " 1 "	4 "	x 6 "	with catch crop of pigeon peas.	
16.	" " " "	6 "	x 6 "	" " " " " "	
17.	" " " "	4 "	x 4 "	forking holes 2 ft. square previous to planting.	
18.	" " " "	4 "	x 4 "	ploughing.	

23. That Mycologist make a study of cause of defoliation in cassava.

RICE.

24. That the Department of Agriculture test the comparative value of local varieties and a few imported varieties.

* To be planted May 29, 1914.

† To be planted June 15, 1914.

All other plots to be planted on June 4 or 5, 1914. When reaping weights of each section to be kept separately.

25. That the Rice Mill be approached with a view to securing importation of a few bags of a standard variety as suggested by the Naparima District Agricultural Society for distribution to growers.

GRAPE FRUIT.

26. That the Department of Agriculture import from Jamaica, Cuba and Florida plants or bud-wood of good varieties of Grape fruit.

LANTERN FOR DEMONSTRATION.

27. That the Advisory Committee be recommended to purchase a lantern at a cost not exceeding \$120 for use in popular talks and demonstrations to employees on estates, &c.

METEOROLOGY.

RAINFALL RETURN FROM JANUARY TO MAY, 1914.

Stations.	May 1914.	May 1913.	Jan. to May, 1914.	Jan. to May, 1913.
<i>North-west District.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>
St. Clair—Royal Botanic Gardens ...	2.05	1.79	5.45	6.93
Port-of-Spain—Colonial Hospital ...	1.49	0.63	4.45	4.78
" Royal Gaol ...	1.89	0.91	5.15	6.44
" Constabulary Hdqrs. ...	2.64	0.59	6.09	5.98
St. Ann's—Reservoir ...	1.78	2.11	5.83	7.05
Maraval— " " ...	2.08	2.61	7.54	9.33
" Constabulary Station ...	2.76	3.59	7.68	10.46
Diego Martin—Constabulary Station ...	3.96	3.17	8.32	9.90
" Waterworks ...	3.62	2.42	8.05	9.79
" River estate ...	3.85	2.32	8.23	9.61
Fort George Signal Station ...	2.66	1.29	8.01	7.60
North Post ...	2.72	1.20	6.20	7.45
Carenage Constabulary Station ...	5.11	1.45	10.26	9.24
Carrera Island Convict Depot ...	2.22	0.71	4.62	5.18
Chacachacare Lighthouse ...	4.25	0.60	8.13	6.12
<i>Santa Cruz—Maracas District.</i>				
Santa Cruz—Constabulary Station ...	2.12	2.38	6.53	11.51
St. Joseph—Government Farm ...	1.57	1.57	7.73	8.17
" Constabulary Station ...	1.24	1.34	6.49	6.54
Tunapuna—St. Augustine estate ...	1.41	1.20	7.98	6.04
Maracas—Government School ...	2.74	2.27	7.21	13.11
" Ortínola estate ...	2.35	2.08	8.63	12.59
Caura—Wardour estate ...	1.90	1.88	7.19	8.54
<i>West Central District.</i>				
Caroni—Frederick estate ...	4.48	3.79	19.23	22.44
Chaguanas—Constabulary Station ...	2.31	1.42	6.90	10.72
" Woodford Lodge estate ...	2.32	1.21	7.82	10.30
Carapichaima—Waterloo estate ...	3.46	1.44	8.66	10.80
" Friendship Hall estate ...	4.40	1.68	10.12	12.59
Couva—Exchange estate ...	1.87	1.33	4.40	7.60
" Brechin Castle estate ...	2.10	2.01	6.11	9.76
" Perseverance " ...	3.34	1.60	7.34	8.42
" Camden " ...	1.77	1.86	4.33	12.04
" Milton " ...	1.16	1.61	4.33	8.63
" Spring " ...	1.53	2.65	5.45	12.50
" Constabulary Station ...	2.89	1.41	5.82	6.75
" Esperanza estate, Savonetta ...	2.03	1.54	5.01	8.84
<i>San Fernando & Princes Town District.</i>				
Claxton's Bay—Forres Park estate ...	1.36	1.23	4.68	8.97
Pointe-à-Pierre—Bonne Aventure est. ...	1.88	2.53	6.91	11.65
" Concord estate ...	2.45	2.44	6.81	12.32
" Plein Palais estate ...	1.05	1.70	3.77	9.52
Naprima—Pieton estate ...	2.05	0.70	6.32	7.53
" Usine St. Madeleine estate ...	2.00	1.39	6.48	12.01
" La Fortuné estate ...	2.75	1.31	6.00	9.13
" Lewisville, San Fernando.. ...	1.85	1.22	6.97	12.36
" Tarouba estate ...	0.86	0.77	3.41	7.46
" Union Hall " ...	1.93	1.71	6.67	7.83
" Palmiste " ...	1.98	1.41	5.76	10.05
" Hermitage " ...	2.12	1.55	7.18	8.71
Princes Town—Craignish " ...	1.67	1.43	8.61	11.28
" Cedar Hill estate ...	1.86	1.18	8.50	9.93
" Williamsville estate ...	1.84	1.57	8.33	12.12
" Esmeralda Estate ...	1.99	1.91	8.88	13.72
" New Grant estate ...	3.21	1.77	10.84	13.39
" Constabulary Station... ...	1.27	1.17	4.36	9.57

RAINFALL RETURN FROM JAN., TO MAY, 1914.—CONTD.

Stations.	May 1914.	May 1913.	Jan. to May, 1914.	Jan. to May, 1913.
<i>San Fernando and Princes Town District.—(Cont'd.)</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>	<i>Ins.</i>
Princes Town—Hindustan estate ..	2.39	1.55	8.79	12.17
„ La Retraite estate ...	3.81	3.63	16.32	17.35
„ Malgretoute estate ...	1.75	1.52	7.64	10.67
Savana Grande—Friendship and Ben Lomond estates ...	1.29	1.29	6.73	9.95
Poole—El Rosario estate ...	3.38	2.65	11.36	22.17
<i>Montserrat District.</i>				
Montserrat Constabulary Station ...	1.92	2.17	7.10	12.38
Brasso—La Vega estate ...	2.87	2.57	9.51	14.61
<i>Arima District.</i>				
Arima—Warden's Office ...	2.59	5.32	7.20	8.64
„ Torrecilla estate ...	3.67	4.44	14.45	14.42
„ Verdant Vale estate ...	3.03	3.38	11.96	14.15
San Rafael—Constabulary Station ...	5.64	2.42	16.68	16.84
Guanapo—Talparo estate ...	3.56	2.91	10.88	16.50
Tamana—Sta. Marta estate ...	5.25	4.27	15.64	20.69
<i>South-west District.</i>				
Oropuche—Constabulary Station ...	5.71	2.64	11.97	11.12
„ Pluck estate ...	3.04	1.57	7.51	8.32
Siparia—Constabulary Station ...	1.94	4.20	12.87	16.58
Guapo—Adventure estate ...	5.69	2.24	9.48	10.33
Cap-de-Ville—Constabulary Station ...	4.63	3.50	11.91	17.48
Erin—La Ressource estate ...	3.58	2.82	8.39	13.22
„ Industry estate ...	3.29	...	8.96	...
Cedros—Constabulary Station ...	2.11	1.96	9.87	10.93
„ Perseverance estate ...	1.58	...	7.37	...
Icacos—Constance estate ...	1.14	1.25	3.81	11.82
Irois—Irois estate ...	3.25	1.96	11.14	14.37
<i>South Coast.</i>				
Moruga—Constabulary Station ...	1.41	2.20	7.59	14.72
<i>North Coast.</i>				
Blanchisseuse—Constabulary Station ...	4.86	4.03	10.36	23.36
Grande Rivière—Mon Plaisir estate ...	* ...	5.51	...	29.75
Toco—Aragua House ...	2.59	4.35	9.83	22.14
„ —Constabulary Station ...	2.85	3.61	10.15	21.45
Point Galera—Light House ...	1.93	1.06	5.01	9.02
<i>East Coast.</i>				
Matura—La Juanita estate ...	4.72	3.91	12.84	24.65
Manzanilla—Constabulary Station ...	2.91	2.28	11.70	20.87
Sangre Grande—Sta. Estella estate ...	4.02	4.17	18.25	24.22
„ New Lands estate ...	4.51	3.67	15.91	35.73
„ Evasdale estate ...	4.41	3.68	17.95	21.19
„ Grosvenor estate ...	3.44	2.77	15.25	20.51
Mayaro—Constabulary Station ...	2.58	1.92	9.01	17.50
<i>Tobago.</i>				
Tobago—Hermitage estate ...	3.32	2.28	13.74	19.71
„ Riversdale „ ...	1.64	1.16	6.21	12.07
„ King's Bay „ ...	3.09	2.54	12.59	17.41
„ Roxburgh ...	3.55	3.08	15.01	21.85
„ Lure estate ...	3.56	3.50	15.37	19.86
„ Botanic Station ...	2.51	1.88	7.76	9.75
„ Government Farm ...	0.71	1.67	3.04	6.59
„ Lowlands estate ...	1.05	2.36	4.47	9.01
„ Friendship estate ...	2.06	1.84	7.25	9.85

(Bulletin, Department Agriculture, Trinidad & Tobago, pp. 177-215. Issued July 8, '14).

* Not received.

BULLETIN
OF THE
DEPARTMENT OF AGRICULTURE,
Trinidad and Tobago.

VOL. XIII.]

JULY, 1914.

[No. 82.

SUGAR.

BREEDING AND COLONIZING THE SYRPHID.*

By P. L. GUPPY.

INTRODUCTION.

THE object of this circular is to place before planters the results of experiments conducted since the departure of Mr. Kershaw in December last year and to point out how the Syrphid can be bred and colonized.

Special Circular No. 8 issued October 23, 1913, (see *Bulletin* XII, pp. 159-61), gives an account of the life history of the Syrphid as far as I could ascertain at that time,—but of course nothing was known of its habits during the dry season, these have only recently been studied and are now given herein.

Certain adverse circumstances have caused delay in bringing these experiments to a successful issue before this, but they have led to important and useful information having been obtained which will make it possible with a little trouble to colonize the Syrphid in the cane fields early in the froghopper season.

The writer is much indebted to Mr. Andrew P. Maingot of Sangre Grande for assistance given whilst observing the dry season-habits of the Syrphid in that district and at Guaico.

Having soon to leave the Colony on urgent private affairs I have issued this circular before going. I have in view further experiments which will be embodied in another circular after my return when I hope to be able to report further progress.

LINES ALONG WHICH EXPERIMENTS WERE TRIED.

It was at first thought feasible to raise adult syrphids in large numbers, —about 200 to 300, and to have them ready for distribution when necessary, — although I had my doubts about carrying this out, it required actual experience and experiments to say for certain whether it was a practical proposition or not.

I accepted the carrying out of this problem feeling that I was undertaking a pretty uphill job which has proved to be a trying one all the time.

* Issued July 16, 1914 as *Special Circular* No. 10.

OBSTACLES TO REARING THE SYRPHID (ADULTS) ON A COMMERCIAL SCALE.

The fact of not being able to obtain a sufficient supply of froghopper nymphs right through the dry season did not at first present itself as a serious obstacle,—it was thought that if *Tomaspis varia* ran short * *T. pubescens* would do,—but the Syrphid will not thrive on the latter, besides which these became quite as scarce as *varia* nymphs.

To raise the requisite number of adult Syrphids would necessitate a regular daily supply of about 1,000 nymphs—this is possible for perhaps about 2 months of the dry season in the early part of the year,—but during April, May, and June, my supplies ran very low, less than 100 per day being the average for some weeks. A great deal depends on the weather of course, but we have to reckon on some prolonged dry seasons from time to time, and these are just the seasons when the Syrphid would be most required.

It is no use trying to raise a few Syrphids in a large cage (24ft. x 12ft.) on account of spiders; a few adult Syrphids would only be sufficient to supply one or two estates; therefore either way this scheme would not be of any practical use.

Regularly every day it is necessary to kill spiders in the large cage. Thanks to Mr. Eugene André's Dabadol, I have been able to kill many thousands without damaging grass, and this spraying compound has saved me a great deal of trouble,—it has also been useful in killing ants which are apt to become too plentiful.

On each occasion that I had Syrphid flies ready to start breeding operations, spiders kept me from making headway, by destroying them before any pairing took place.

The Syrphid is rather a stupid insect and its resemblance to a wasp does not seem to protect it,—it will generally manage to alight just where a spider is waiting for something to turn up: of course if there were several in a cage the loss of a few would not matter, but with the scarcity of nymphs, no more than a few could have been kept going, and so with these obstacles to face, I had to turn my attention to the possibility of devising a new scheme of Syrphid breeding.

NEW SCHEME FOR SYRPHID BREEDING.

Experiments were tried in October last year in order to find out what kind of cage, and in how small an area the Syrphid (adults) would thrive. Large glass jars were used, 15 in. x 9 in., with muslin caps. A small cage, 4 ft. x 2 ft., was also tried but without success. The Syrphid did not seem at home in any such restricted areas, and it was therefore thought necessary to construct a cage at least 18 ft. x 6 ft. The cage finally put up was 24 ft. x 12 ft. and was built over a well-watered green patch which had been specially prepared for sometime beforehand. When this cage was found unworkable on account of spiders as explained above, I was much puzzled to know what could be tried next to save the few Syrphids that I tracked down from time to time during the dry-season.

* The "black" froghopper often very abundant along the grassy banks of streams in the valleys. It is not found in the canefields.

When, on April 4, I bred a female Syrphid from Guaico grass I determined to go to the other extreme and put it in a lamp-chimney, 9 in. x 4 in., quite a restricted area, but with different treatment from that tried in former experiments. This was quite successful and she lived 25 days. Another one (a female) which issued on May 22 and was treated in the same way lived 20 days. I felt sure now of solving the problem of carrying on the Syrphid through the dry season, but of course with a different object in view,—and that is,—to distribute eggs, on recently hatched maggots, instead of liberating adults, when colonizing is being attempted.

I knew that a female Syrphid would lay in a confined area as long as there was frog hopper froth in which to insert her ovipositor. In fact I have again verified this to my cost,—a female which issued on June 22 laid 104 eggs in 3 days without having mated!

My new scheme is to use lamp-chimneys, 9 in. x 4 in., for putting females in to lay after they have paired. This apparatus is shown on Plate II, figs. 1 and 2, also to have a pairing cage, Plate I, fig. 1, as it seems necessary to have a cage at least 6 x 6 x 6 for this purpose, details of which are given below.

DIMENSIONS, &c., OF PAIRING CAGE.

A square cage 6 ft. x 6 ft. x 6 ft. is a convenient and economical size to build. The wire cloth for covering is 3 feet wide, so that two widths will cover each side without cutting.

The legs should be at least 1 ft. 6 in. long. Large pudding pans, or half kerosene tins or some such means are to be used for putting them into oil and water to prevent ants, &c., from getting up into the cage.

2 in. x 2 in. pitch pine scantling is suitable for frame, and there must be pitch pine boards 12 in. wide nailed around bottom, and of course, a flooring of the same to hold earth and grass to be planted.

The door should not be hinged, but made to slide up and down in a groove so that the side attachment, B., can be used effectively. This portion of the cage is to permit of entry into the cage without risk of flies escaping,—it is also convenient for sitting in to watch movements of flies. The weather side, and side opposite to door, must be boarded up and a piece of waterproof material laid on top,—this will keep the floor dry and also make it darker inside than the main cage, and so make observation easier.

Such a cage with all appliances should not cost more than \$20,—including materials, workmanship, and planting up.

PREPARATION OF PAIRING CAGE.

First spread rotten cane trash over bottom of cage to a depth of a few inches, then spray thoroughly with 4 gallons (kerosene tin full) of Dabadol mixture.

Use an empty condensed milk tin as a measure for the quantity of Dabadol and pour this into a kerosene tin full of water. Stir for 5 minutes briskly and then it is ready for use. It can be applied with an ordinary watering can or garden syringe. About half an hour

after this the grass can be planted. The best way to do this is to dig up pieces of turf, mostly "Savannah" grass, with some roots of Para grass here and there,—let there be a good lump of earth at the roots of the grass,—but avoid putting any in with ants, spiders, or spider's web, *as far as possible*,—after closely planting up, spray again with 4 more gallons of Dabadol mixture as before.

These precautions will save a great deal of trouble later on, as any spiders, and ants, &c., will pretty surely all be killed.

It is also most important that the cage be thoroughly shaded.

It must be placed behind a thick hedge which will prevent wind sweeping through.

The great thing is to shut out most of the top-light,—the Syrphids require very little sun. A few little spots of sun here and there is really all that is required. If the cage can be built under a shady tree so much the better, but it must also have palm fronds on the top, and others inside nailed to the corners of the cage. A small palm or other plant growing in a kero. oil tin placed in the middle of the cage is an excellent way of making the interior agreeable to the Syrphid.

Everything to be put into the cage must be examined and sprayed, as spiders are everywhere.

Some green cloth material about 18 inches wide nailed around top of cage is a good way of shutting out light and keeps the Syrphids down below which is important,—when they are seen to fly and alight on blades of grass low down this is a certain indication that they are feeling at home.

A cage should take about 2 days to get ready and another 2 days watering, if there is no rain, before putting in froghopper nymphs and Syrphids. The former should be placed in corner of cage near door so that the froth can conveniently be examined for Syrphid eggs.

Within a week therefore a pairing cage can be got ready for use.

LAMP-CHIMNEY APPARATUS.

The lamp-chimney apparatus (Plate II. figs. 1 and 2) is a necessary adjunct to the pairing cage.

As many divisions as desired can be made, probably three will be found sufficient.

The measurements should be accurate so as to allow the bottom of each chimney to fit into wooden hole exactly, and the lid pressed on the top so as to keep rigid and avoid capsizing.

The pudding pans with grass roots and froth are placed underneath and kept in place by means of elastic straps hooked on across the bottoms as shown in fig. 3, Plate II.

Each chimney has a muslin cap to which is pinned a small bunch of teased-out cane trash, or dry grass.

If a pairing is observed (*See* fig. 2 Plate I.) so much the better, after half an hour there is a separation, then the female can be removed by catching her with a net when at rest. Supposing there is more than one female in the cage and there is doubt about which one has paired, it is better to wait about 2 days and then capture the two or three in the

cage. By that time all should have paired if there are several males. It is however advisable to keep a sharp look out for any pairing and try and get the female out as soon as possible to transfer her to lamp-chimney. By means of a tube the Syrphid can be captured in the net and a plug of cotton wool inserted in the opening to keep her in. This must be done with great care as the fly is sometimes very quick and may escape during the process.

The lamp chimney itself which is to be used for keeping the fly in can also be used for trapping her with a piece of cardboard to be placed on the bottom when she is caught.

A good way of keeping the Syrphid quiet when in the tube is to smear a little syrup on a blade of grass and insert by carefully and partially removing plug. She will soon settle down to feed and when thus occupied the tube, after gently removing plug, can be slipped into the pudding pan, as the latter is held ready, with grass roots and froth, under the lamp chimney (see Plate II. fig. 2 G.) The tube can be allowed to remain inside, and rubber strap fastened as shown in fig. 2, Plate II.

Pudding pans are to be removed every other day, after first seeing that the Syrphid is on the trash, or grass on top, as shown in fig. 1, Plate II. as it might be below laying. Early morning (6 a.m.) is the best time to remove the pudding pans.

Syrphid eggs can be readily seen in the froth and the fly will sometimes lay as many as 30 in the froth of one nymph.

It is important that the lamp-chimney apparatus is kept in a room with subdued light and away from windows.

NUMBER OF ADULT SYRPHIDS TO BE PUT IN PAIRING CAGE AND METHOD OF FEEDING, &c:—

No more than 10 Syrphids should be in the pairing cage of which only 3 females are required, there should be about twice as many males.

With a view of suggesting a method which can be adopted by any planter who wishes to spread, or accelerate the progress of the Syrphid over his cane-fields, the following process is recommended:—

Two large glass jars (confectionery jars) are good for the purpose, five maggots to be put into each.

To prepare jars, put about an inch of sand or earth over bottom and moisten this; then put in grass roots with nymphs; each morning drop in the requisite number of nymphs, about 30, these will attack themselves to the grass-roots where the maggots will attack them.

Lamp-chimney apparatus can be dispensed with. Pairing cage only will be necessary. From froth near door enough eggs will be found to distribute to various fields.

Glass jars with pupæ are to be put in pairing cage and in about 9 days flies will issue, and about 2 days after that search for eggs in froth can commence.

From 8 females between 500 and 1,000 eggs should be obtained which is quite sufficient to establish the Syrphid on any estate for practical purposes.

It is important to feed and water the Syrphid twice a day, at 8 a.m. and 4 p.m. or thereabouts.

A supply of syrup must be kept handy in a drop-bottle (fig. 4, plate II.) *. A clear glass whisky bottle is best, with a small tube let in through the cork, and contents can be shaken out in small drops. For lamp-chimneys shake the bottles over the muslin till drops fall through on to the grass roots below, and some remain on trash suspended at top. Water is to be sprinkled in same way twice a day.

For the cage, the syrup must be scattered over the foliage, *i.e.*, on the grass blades mostly and water thrown over top.

The Syrphid seems rather silly about finding its food, so it is good to be liberal, and scatter about thoroughly,—the success of this scheme depends on having them *well fed, well watered, and kept in a cool, shady place, where there is little or no wind.*

At St. Augustine a stock of 20 Syrphid maggots will be kept in hand for breeding purposes. All other eggs and maggots can be placed in suitable localities as soon as possible and left to look after themselves.

20 maggots would require a supply of about 60 nymphs a day, quite as many as can be got in the dry season when froghoppers are scarce. Several maggots should not be kept any time in a small jar or tube; after they are two days old separate them in lots of 5, and put into different jars, or tubes. If crowded they are apt to kill one another.

HABITS OF THE SYRPHID, WITH OTHER NOTES.

Most of these observations were made whilst hunting for the Syrphid in its dry season haunts at Guaico, about a mile along the Guaico-Tannana Road.

In nature the female Syrphid travels under cover of trees and shrubs from place to place looking for suitable localities to oviposit. On cloudy and rainy days she will move long distances; in bright sunshiny weather she seeks the shady protected groves, and borders of woods, or bushy places, and does not move far,—except she can do so along the shady side of a hedge, or bottom of a grassy drain where there will be protection from both sun and wind. Now and then she may sun herself a little but *not* in the open,—she will select just a spot of sun that has filtered through the leaves of an overhanging branch, and she will sit perched on the tip of a blade of grass, quite near the ground;—the males generally remain in one locality and wait for a passing female,—there are always more males seen about,—and the initial act of pairing takes place on the wing,—if a male succeeds in clasping the abdomen of the female, the pair drop down and remain on the underside of a leaf *in coitu* for about half an hour after which they separate.

The Syrphid is very fond of a small white flower which is abundant in most places and blooms throughout the year. The flower is borne in clusters between the petiole and stems of this low-growing plant which

* It is easier to see whether supplies are running down. Syrup made by dissolving two lumps of white sugar in 3 oz. water.

has small elongate leaves, it is abundant on the edge of grassy drains at the side of hedges where it only gets a moderate amount of sun. It is very plentiful in Guaico and Sangre Grande in situations where the Syrphid was obtained during the dry-season.

The Syrphid feeds on the pollen of these flowers and I generally break some of them off and stick them in the earth around the froth that is to be put for the Syrphid to lay in under the lamp chimneys.

The female should mate as soon as possible after issuing from pupa, (within a day or two,) as she is apt to lay a large proportion of unfertile eggs. This can be arranged by putting into the pairing cage about 10 pupæ which will hatch about the same date.

Of 2 females bred recently from Guaico grass, one laid 104 eggs in 3 days,—both of these laid numbers of unfertile eggs,—and I was afraid that I would lose the chance of getting any fertile eggs, when fortunately 3 males issued a week after before all the eggs were laid and I was able to get a fair supply of young maggots to start my colonizing scheme.

The bird-reserve scheme mentioned in Bulletin 79, Vol. XIII., p. 127, (March-April, 1914) would provide attractive situations for the Syrphid.

It is not advisable to try and colonize the Syrphid where the nymphs are too scattered. I am in hopes that by the end of July there will be enough eggs or young maggots to start colonizing in certain centres.

The Syrphid under usual conditions does not spread much in the cane-fields till towards the end of the year, to get them started a couple of months earlier would doubtless be of considerable help to the Planter.

I am under the impression that boucans tend to retard the progress of the Syrphid as it appears that most of the nymphs get under these early in the season, so that the fly is not able to lay in the covered down froth, of course the maggots would reach these nymphs, but it is probable that the Syrphid would lay more eggs and so multiply more rapidly if there were fewer boucans.

The adult (female) Syrphid lives from 20 to 25 days, but this depends on egg-laying,—all her eggs might be laid in 10 days and then she would die. Males seem to die soon after copulation, otherwise they live as long as the females.

The life-cycle is :—

Egg-stage	2 days (to 3 days).
Maggot stage	9 ..
Pupal stage	9 ..
Total	20 days.

As stated in *Special Circular* No. 8, the footless maggots resemble the bodies of nymphs. Of course when just hatched they are almost colourless and are not easily seen except when they move about in the froth.

The pupa (plate 1, fig.5), is short and thick, club-like in shape, and very much like trash in colour,—it is always quite low down, attached to a stem or blade of grass near trash, and sometimes on the trash itself.

EXPLANATION OF PLATE I.

Fig. 1. Pairing cage. A1, P.P. board or green cloth nailed around top to shut out top-light—A2, window to attract female Syrphids. A3, plank for standing on inside cage. A4, P.P. board nailed around sides below. A5, sliding door opening into B. side attachment for observing movements of Syrphids, &c :—

Dimensions of A. 6 ft. x 6 ft. x 6 ft.

„ B. 3 ft. 6 in. x 2 ft. 6 in.

Fig. 2. Position of Syrphids in pairing.

- „ 2a. Abdomen of male. Side view showing “clasper.”
- „ 2b. Abdomen of female. Side view.
- „ 3. Syrphid at rest on end of grass flower stalk (Savannah grass).
- „ 4, 4a. Syrphid eggs in froth on grass roots, egg enlarged shown on right.
- „ 5. Pupa, or chrysalis, low down on stem or blade of grass,—same colour as trash.

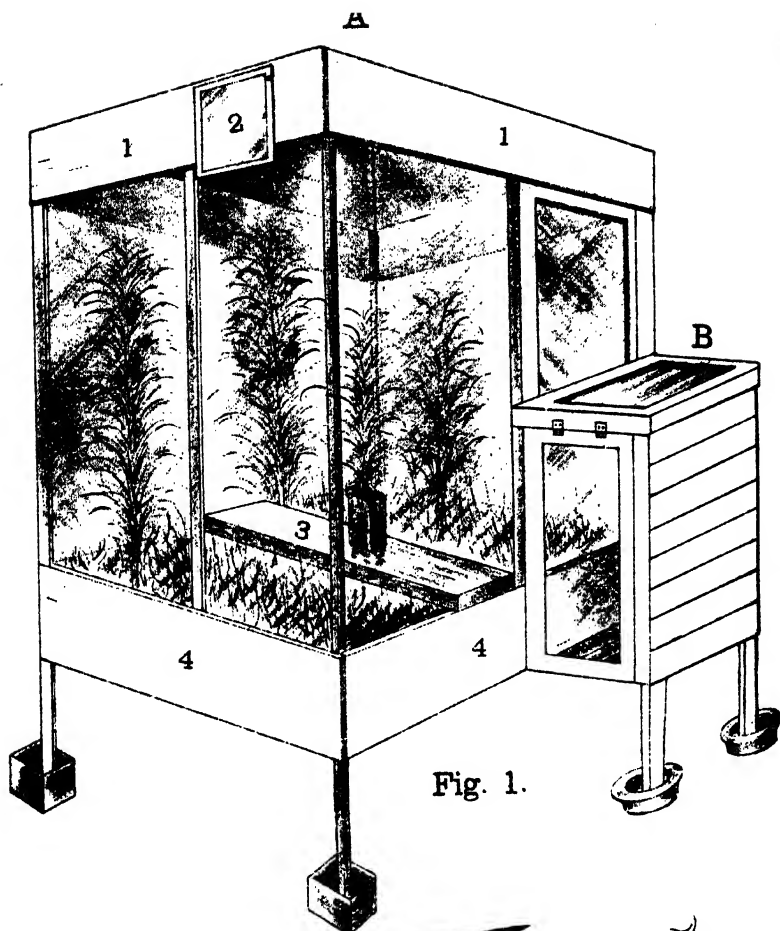


Fig. 1.

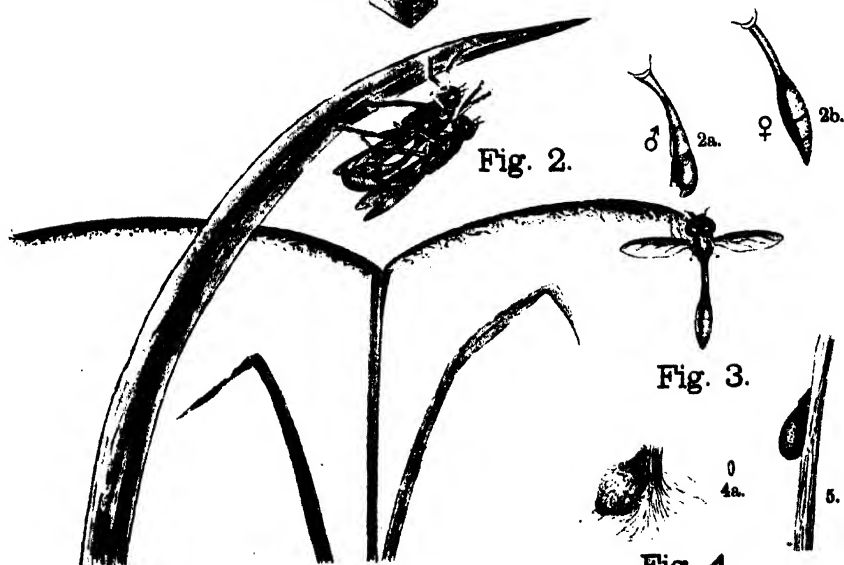


Fig. 2.

Fig. 3.

Fig. 4.

EXPLANATION OF PLATE II.

Fig. 1. Lamp chimney fitted up for use showing female Syrphid on trash.
(Lamp chimney 9 in. by 4 in.)

Fig 2. Apparatus for putting chimney into, to enable pudding pans to be changed when egg-bearing froth is to be removed.

2 G shows how tube with fertilized female is put into lamp-chimney; 2 F showing female already in; 2 H empty.
(See p. 220).

Fig. 3. Pudding pan strapped under chimney.

Fig. 4. Drop bottle for syrup or water to be sprinkled on muslin cap for feeding and watering Syrphid. (See p. 221).

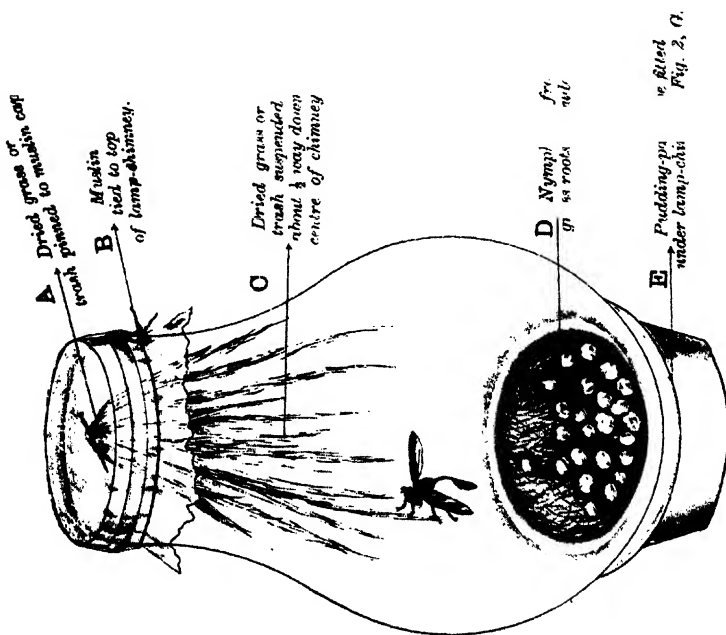
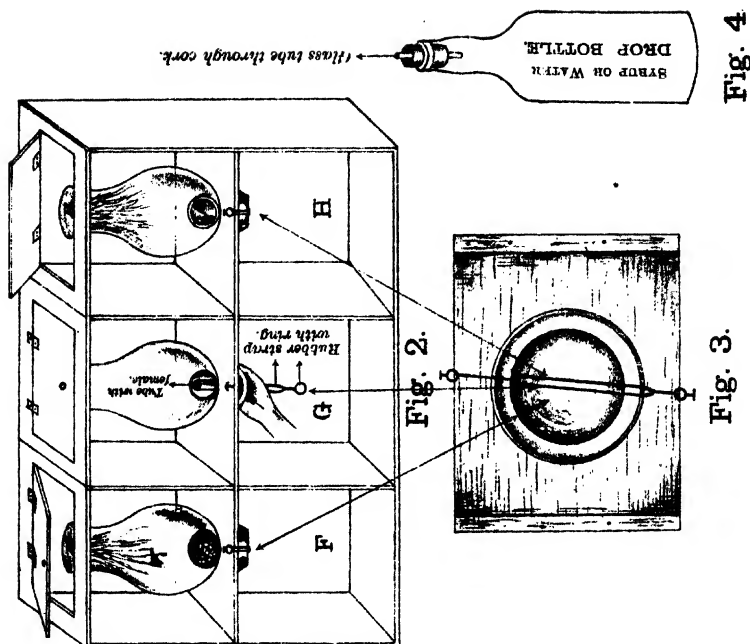


Fig. 1.



MANURIAL EXPERIMENTS ON SUGAR CANE, 1912-14.

BY JOSEPH DE VERTEUIL, F.C.S.,
Superintendent of Field Experiments.

MANURIAL experiments, under the control of the Board of Agriculture, have been carried out, during the past year, on the Brechin Castle estate Couva; Esperanza estate, California; and Malgretoute estate, Princes Town.

The experiments were made on plant canes and the general arrangement of the plots is shown in the diagram below:—

DIAGRAM SHOWING ARRANGEMENT OF THE PLOTS.

2	3	4	5	6	7	8	1
3	4	5	6	7	8	1	2
4	5	6	7	8	1	2	3
5	6	7		1	2	3	4
6	7	8	1	2	3	4	5
7	8	1	2	3	4	5	6
8	1	2	3	4	5	6	7
1	2	3	4	5	6	7	8

Each experiment has been made on eight equal plots similarly treated, and accordingly the result given for each plot is the mean of eight duplications.

The fields under experiment are among the most even on the estates and it was hoped that any irregularities in the soil would have been reduced to a minimum.

The kind and quantity of manures applied per acre to the plots on each estate were as follows:—

Plot 1.	{ 45 lb. nitrogen, from calcium nitrate. 40 lb. phosphates, from dissolved bones. 28 lb. potash, from sulphate of potash.
Plot 2.	{ 45 lb. nitrogen, from sodium nitrate. 40 lb. phosphates, from dissolved bones. 28 lb. potash, from sulphate of potash.
Plot 3.	{ 45 lb. nitrogen, from calcium cyanamide. 40 lb. phosphates, from dissolved bones. 28 lb. potash, from sulphate of potash.
Plot 4.	{ 45 lb. nitrogen, from sulphate of ammonia. 40 lb. phosphates, from dissolved bones. 28 lb. potash, from sulphate of potash.
Plot 5.	{ 45 lb. nitrogen, from sulphate of ammonia. 40 lb. phosphates, from dissolved bones.
Plot 6.	{ 45 lb. nitrogen, from sulphate of ammonia. 40 lb. potash, from sulphate of potash.
Plot 7.	45 lb. nitrogen, from sulphate of ammonia.
Plot 8.	Control.

The cost of manuring includes the value of the manures landed in Port-of-Spain and the cost of application.

The value of the canes reaped has been calculated on a basis of \$2.40 (10s.) and \$3.00 (12s. 6d.) per ton. At the former price only plot 1 at Esperanza shows a profit, if however, the calculations were based on a price of \$3.60 (15s.) per ton, a fair profit would be obtained from the majority of the plots. This clearly demonstrates the manner in which the value of the produce affects the profit to be derived from the application of manures.

The juice from the canes reaped on each plot at Brechin Castle, was sampled at the factory-mill and analysed by Dr. A. Urich, Ph. D., F.I.C., to whom my thanks are due for his kind assistance. The samples from Esperanza were personally taken and analysed by me on the spot at the estate's laboratory.

The season under review—from the application of the manures to the date of reaping—has been a fairly dry one and although the canes were about 18 months old when cut at Brechin Castle and Esperanza, they were still very green as can be seen, on reference to the results of the analysis of the juice, at pages 281 and 283.

RAINFALL.

The rainfall on each estate from the date of planting to the date of reaping the canes is given below:—

		<i>Brechin Castle.</i>	<i>Esperanza.</i>	<i>Malgretoute.</i>
		<i>Inches.</i>	<i>Inches.</i>	<i>Inches.</i>
September, 1912	...	9·07	—	—
October, „	...	3·26	3·09	—
November, „	...	6·39	6·16	5·39
December, „	...	4·50	3·95	7·29
January, 1913	...	5·88	5·35	6·23
February, „	...	0·56	0·83	0·27
March, „	...	1·00	1·81	0·61
April, „	...	0·31	1·16	0·19
May, „	...	2·01	1·52	1·54
June, „	...	7·15	8·85	5·80
July, „	...	4·17	3·52	3·91
August, „	...	7·23	6·88	5·90
September, „	...	10·49	9·01	5·06
October, „	...	6·45	5·96	6·69
November, „	...	7·51	6·49	10·41
December, „	...	4·76	5·50	4·13
January, 1914	...	1·14	0·95	1·55
February, „	...	1·06	0·33	1·94
March, „	...	—	0·00	1·04
April, „	...	—	—	1·36
May, „	...	—	—	1·75
		<hr/> 82·94 <hr/>	<hr/> 71·36 <hr/>	<hr/> 71·04 <hr/>

BRECHIN CASTLE ESTATE.—COUVA.

The soil is a flat clay loam and was planted with B. 156 on September 7, 1912. 7 cwt. of lime with a mixture of about 10 tons per acre of ashes from the furnaces and mud from the filter-press was applied on January 11, 1913.

The artificial manures were applied on May 22, 1913. Plots 9 and 10, the estate plots, were treated with 2 cwt. per acre of the following mixture:—

- 64 lb. sulphate of ammonia.
- 48 lb. nitrate of soda.
- 80 lb. mineral superphosphate.
- 32 lb. sulphate of potash.

The quantity usually applied is 3 cwt. per acre, but as the canes had made such good growth, the second application of 1 cwt. was not made.

Each of the estate's plots is equal in size to the total of the eight experiment plots *i.e.* approximately two acres.

The canes were reaped between March 16 and 25, 1914, and were about 19 months old. 52·20 inches of rain were registered on the estate from the time of applying the manures to the date of reaping.

MANURIAL EXPERIMENTS, BRECHIN CASTLE ESTATE, COUVA—
PLANT CANES B. 156.

Plot.	MANURES APPLIED.	PER ACRE.					
		Yield of Canes.	Increase or Decrease on no manure.	Value of Increase or Decrease, at \$2.40 per ton.	Cost of Manuring.	Profit or Loss on no manure when canes are worth, per ton.	
						\$2.40 (10s.)	\$3.00 (12s. 6d.)
		Tons.	Tons.	\$ c.	\$ c.	\$ c.	\$ c.
1	{ Calcium nitrate ... Dissolved bones ... Sulphate of potash ... }	48.97	5.40	12.96	13.09	- 0.13	+ 3.11
2	{ Sodium nitrate ... Dissolved bones ... Sulphate of potash ... }	44.41	0.84	2.02	12.21	- 10.19	- 9.69
3	{ Calcium cyanamide ... Dissolved bones ... Sulphate of potash ... }	44.55	0.98	2.35	10.02	- 7.67	- 7.08
4	{ Sulphate of ammonia ... Dissolved bones ... Sulphate of potash ... }	47.45	3.88	9.31	11.31	- 2.00	+ 0.33
5	{ Sulphate of ammonia ... Dissolved bones ... }	46.61	3.04	7.30	9.87	- 2.57	- 0.75
6	{ Sulphate of ammonia ... Sulphate of potash ... }	46.57	3.00	7.20	9.66	- 2.46	- 0.66
7	Sulphate of ammonia ...	46.52	2.95	7.08	8.22	- 1.14	- 0.63
8	Control—No manure ...	43.57	...	...	...	...	...
9	Estate plot A. ...	46.06	...	...	...	...	...
10	Estate plot B. ...	42.18	...	...	...	...	...
	Average of Estate plots ...	44.12	0.55	1.32	5.28	- 3.96	- 3.63

The large yield obtained from all the plots tends to show that the application of a mixture of ashes and mud from the filter-presses, at the rate of 10 tons per acre, is sufficient for growing a good crop of canes on the field under experiment.

All the plots which have been treated with artificial manures have given a larger tonnage of canes per acre than the control plot, but the increase has not been sufficient to pay for the cost of the artificial manures when canes are valued at \$2.40 (10s.) per ton.

With canes worth \$3.00 (12s. 6d.) per ton, a profit of \$3.11, \$0.63 and \$0.33 per acre has been obtained from plots 1, 7 and 4 respectively.

By comparing the results obtained from plots 1, 2, 3 and 4, the nitrogen series—it will be observed that plot 1, the calcium nitrate plot has given the largest profit, viz., \$3.11 per acre.

The sulphate of ammonia plot No. 4 comes next with a profit of only \$0.33 per acre, whereas the sodium nitrate and calcium cyanamide plots, Nos. 2 and 3, show a loss of \$9.69 and \$7.08 respectively.

If we compare plots 4 and 7 it will be seen that no benefit has been derived from the application of phosphates and potash with sulphate of ammonia or from the application of phosphates or potash alone with sulphate of ammonia as can be seen from a comparison of plots 5, 6 and 7.

RESULTS OF ANALYSIS OF JUICE FROM THE EXPERIMENT PLOTS—
BRECHIN CASTLE ESTATE.

Plot.	Brix.	Percentage of.		Quotient of purity.	B. Sucrose per gal.	Remarks.
		Sucrose.	Glucose.			
1	17.1	13.95	2.09	81.6	1.493	Average of 2 analyses.
2	17.7	14.38	1.48	81.2	1.543	„ „ „
3	17.4	13.88	*	79.8	1.488	„ „ „
4	17.5	14.28	*	81.6	1.531	„ „ „
5	17.5	14.21	1.78	82.1	1.522	„ „ „
6	17.1	13.88	1.72	81.2	1.486	„ „ „
7	17.4	14.02	*	80.6	1.503	„ „ „
8	17.0	14.00	1.67	82.3	1.498	„ „ „

Mill extracts about 63 per cent. juice.

* Not estimated.

ESPERANZA ESTATE—CALIFORNIA.

The soil is a flat sandy loam and was planted with B. 147 on October 1, 1912. 10 cwt. of lime were applied in December 1912, and 15 tons of pen manure per acre in February 1913.

The artificial manures were applied on June 14, 1913. Two plots 9 and 10, of identically the same size as the whole of the experiment plots, situated on either side of these, received no artificial manures. The weight of canes, per acre, obtained from these is somewhat lower than the results from the control plot, and clearly indicate that the latter has been in a favourable situation. In calculating the profit or loss on *no manure*, therefore, the average of plots 8, 9 and 10 (which did not receive any artificial manures) has been considered as the control plot. The canes were reaped on April 6, 7 and 8, 1914 and were about 18 months old. 46.83 inches of rain were registered from the date of applying the manures to the date of reaping. No rain was registered on the estate from March 1 to April 8, 1914.

MANURIAL EXPERIMENTS—ESPERANZA ESTATE, CALIFORNIA—
PLANT CANES B. 147.

Plot.	MANURES APPLIED.	PER ACRE.					
		Yield of Canes.	Increase or Decrease on average of no manure plots.	Value of Increase or Decrease, at \$2.40 per ton.	Cost of manuring.	Profit or loss on average of no manure plots 8, 9 and 10, when canes are worth, per ton.	
		Tons.	Tons.	\$ c.	\$ c.	\$ c.	\$ c.
1	{ Calcium nitrate Dissolved bones Sulphate of potash }	24.06	+ 7.13	+ 17.11	13.09	+ 4.02	+ 8.30
2	{ Sodium nitrate Dissolved bones Sulphate of potash }	21.79	+ 4.86	+ 11.66	12.21	- 0.55	+ 2.37
3	{ Calcium cyanamide Dissolved bones Sulphate of potash }	20.20	+ 3.27	+ 7.85	10.02	2.17	- 0.21
4	{ Sulphate of ammonia Dissolved bones Sulphate of potash }	17.70	+ 0.77	+ 1.85	11.31	- 9.46	- 9.00
5	{ Sulphate of ammonia Dissolved bones }	17.93	+ 1.00	+ 2.40	9.87	- 7.47	- 6.87
6	{ Sulphate of ammonia Sulphate of potash }	16.34	- 0.59	- 1.42	9.66	- 11.08	- 11.43
7	Sulphate of ammonia ...	17.48	+ 0.55	+ 1.32	8.22	- 6.90	- 6.57
8	Control—No manure ...	23.15	...	...	...	...	...
9	Estate plot A—No manure...	15.43	...	...	...	...	...
10	Estate plot B—No manure...	17.79	...	...	...	...	...
	Average of no manure plots 8, 9 & 10 }	16.93	...	...	...	...	...

With the exception of plot 6, there has been an increase in yield over the average of the "no manure" plots 8, 9 and 10, but except in the case of plot 1, the increased yield has not been sufficient to pay for the cost of the artificial manures when canes are valued at \$2.40 (10s.) per ton.

With canes worth \$3.00 (12s. 6d.) per ton, plots 1 and 2 show a profit of \$8.30 and \$2.37 respectively over the average of the "no manure" plots, and as is the case on the Brechin Castle estate the calcium nitrate plot is the best. This is the second occasion, on which the calcium nitrate plot shows a large profit over the control plot and it is suggested that a trial might be made with this manure on a somewhat larger scale on the sandy loam soils of this estate.

It will be observed that all the plots treated with sulphate of ammonia show a loss. This and the poor yield obtained generally might be attributed to the comparatively poor rainfall since applying the manures and to the

fact that only 1.28 inches of rain was registered on the estate during the four months preceding the reaping of the canes.

By comparing plots 4, 5, 6 and 7, it will be observed that there has been an additional loss of \$2.43 by the application of phosphates and potash with sulphate of ammonia and that no benefit has been derived from the application of phosphates or potash alone with sulphate of ammonia.

The results recorded, however, should be accepted with reserve as it would appear that the land is not very uniform, judging from the results obtained from the "no manure" plots 8, 9 and 10.

RESULTS OF ANALYSIS OF JUICE FROM THE EXPERIMENT PLOTS—
ESPERANZA ESTATE.

Plot.	Brix.	Percentage of.		Quotient of purity.	lb. Sucrose per gal.	Remarks.
		Sucrose.	Glucose.			
1	18.5	15.93	2.01	86.1	1.715	Average of 2 analyses.
2	18.6	15.98	1.93	85.9	1.721	" " " "
3	18.7	16.19	1.83	86.6	1.744	" " " "
4	18.7	16.18	1.83	86.5	1.743	" " " "
5	18.7	16.28	1.81	87.0	1.754	" " " "
6	18.8	16.26	1.83	86.5	1.753	" " " "
7	18.7	16.26	1.89	86.9	1.752	" " " "
8	18.4	15.72	2.02	85.4	1.692	" " " "
9*	18.7	16.27	1.68	87.0	1.753	" " 3 "
10†	19.3	16.77	1.41	86.9	1.811	" " " "

Mill extracts about 59 per cent. juice.

* 8 beds situated to the South of experiment plots.

† 8 beds situated to the North of experiment plots.

MALGRETOUTE ESTATE—PRINCES TOWN.

The land is an undulating red soil and was planted with B. 6450 on November 9, 1912. Two tons of air-slaked lime per acre was applied to the land a couple of days before planting and pen manure at the rate of 15 tons per acre was applied about the middle of January, 1913.

The artificial manures were applied on June 24, 1913 and the estate plot 9 which has an area of 4,900 square feet received an application of Peruvian guano at the rate of 3 cwt. per acre.

The canes were reaped between June 9 and 11, 1914 and were 19 months old. 44.20 inches of rain were registered on the estate from the time of applying the manures to the date of reaping.

**MANURIAL EXPERIMENTS—MALGRETOUTE ESTATE, PRINCES TOWN—
PLANT CANES B. 6450.**

Plot.	MANURES APPLIED.	PER ACRE.					
		Yield of Canes.	Increase or Decrease on no manure.	Value of Increase or Decrease, at \$2.40 per ton.	Cost of Manuring.	Profit or Loss on no manure when canes are worth, per ton.	
						\$2.40 (10s.)	\$3.00 (12s. 6d.)
		Tons.	Tons.	\$ c.	\$ c.	\$ c.	\$ c.
1	{ Calcium nitrate Dissolved bones Sulphate of potash }	26.54	+3.33	+ 7.99	13.09	- 5.10	- 3.10
2	{ Sodium nitrate .. Dissolved bones... Sulphate of potash }	25.35	+2.14	+ 5.14	12.21	- 7.07	- 5.79
3	{ Calcium cyanamide Dissolved bones Sulphate of potash }	23.74	+0.53	+ 1.27	10.02	- 8.75	- 8.43
4	{ Sulphate of ammonia Dissolved bones... Sulphate of potash }	23.77	+0.56	+ 1.34	11.31	- 9.97	- 9.63
5	{ Sulphate of ammonia Dissolved bones }	17.84	- 5.37	- 12.89	9.87	22.76	25.98
6	{ Sulphate of ammonia Sulphate of potash }	21.88	- 1.33	- 3.19	9.66	12.85	- 13.65
7	Sulphate of ammonia ...	21.62	- 1.59	- 3.82	8.22	- 12.04	- 12.99
8	Control—No manure..	23.21	...	...	...	...	...
9	{ Estate plot Peruvian guano... }	30.31	+7.10	+17.04	8.00	+11.01	+13.30

Plots 1, 2, 3 and 4 have given a larger tonnage of canes per acre than the control plot but in no case has the increase been sufficient to pay for the extra cost of manuring. The estate plot alone shows a profit \$11.04 per acre.

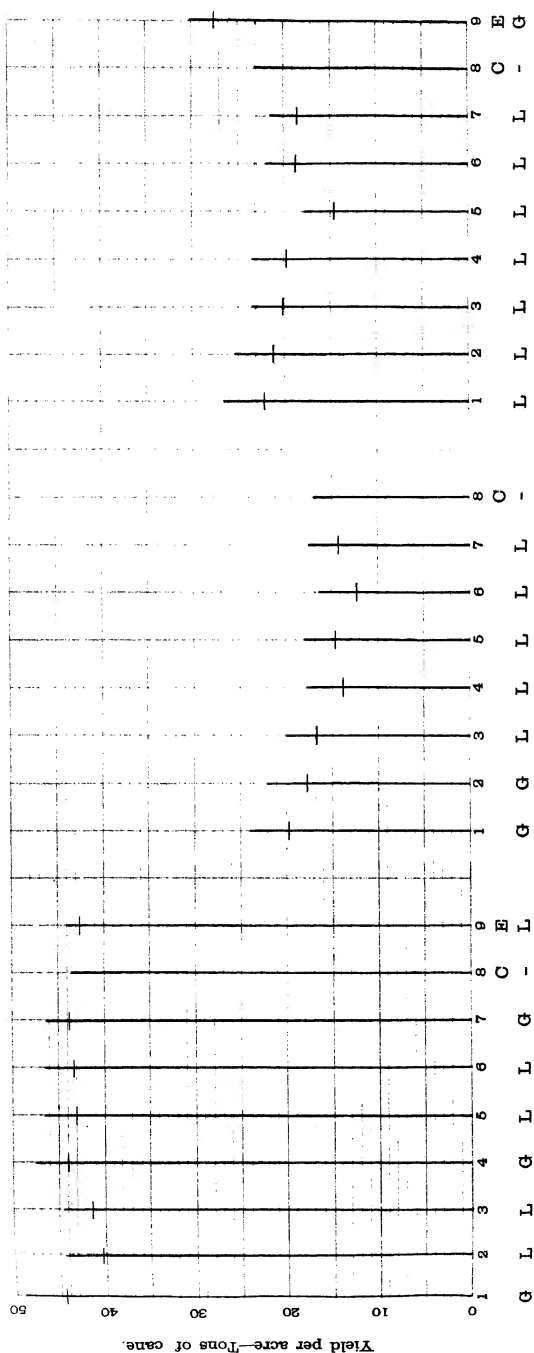
On this estate the complete manure plots 1, 2, 3 and 4 have given higher yields than sulphate of ammonia applied alone, or than sulphate of ammonia applied with phosphates or potash.

The tonnage of canes reaped per acre and the pecuniary results obtained for each plot on the three estates, are shown graphically in the following diagram.

Brechin Castle Estate
Plant Canes B. 156.

Esperanza Estate
Plant Canes B. 147.

Maigretoute Estate
Plant Canes B. 8450.



EXPLANATION OF DIAGRAM.

The plots are indicated by the numbers 1, 2, 3, 4, etc.
 G means Control; B = Estate's plot; G and L = Gain or Loss respectively on Control plot.
 Each distance from 0 to 10, 10 to 20, etc., represents ten (10) tons of cane per acre and therefore the space from any one horizontal line to the next is equivalent to one (1) ton of cane or \$2 from a monetary point of view.
 The dotted red line indicates the yield of the Control plot throughout the series of the experiments for each estate.
 The portions of the vertical lines above the short horizontal black marks represent the quantity of cane, valued at \$3 per ton, required to pay for the cost of manuring.
 When the black dash comes above the red line a profit has been obtained, when below it shows a loss. The vertical distance from the red line to the dash, above or below, is equivalent to the gain or loss in manuring. For example, the distance from the red line to the dash for plot 1 at Brechin Castle, is equivalent to the distance between two horizontal lines and therefore represents a gain of approximately \$3; the distance above the black dash to the top of the column representing the amount of cane required to pay for the manuring.

- Plot. Manures applied.
1. Nitrate of lime
Dissolved bone
Sulphate of potash
 2. Nitrate of soda
Dissolved bone
Sulphate of potash
 3. Calcium cyanamide
Dissolved bone
Sulphate of potash
 4. Sulphate of ammonia
Dissolved bone
Sulphate of potash
 5. Sulphate of ammonia
Dissolved bone
 6. Sulphate of ammonia
Sulphate of potash
 7. Sulphate of ammonia
 8. Control
 9. Manure plot

CACAO.

CACAO BUDDING DEMONSTRATION AT ST. CLAIR.

THE members of the Agricultural Society visited St. Clair Experiment Station on July 10, to see the budded cacao plants and witness a demonstration of the methods employed.

Mr. W. G. Freeman, Acting Director of Agriculture, gave a short resumé of the results achieved by the Department in Trinidad and Tobago and also of other work along more or less similar lines in Jamaica, Hayti, Dominica and the Philippines (see this *Bulletin* xiii. December 1913, pp. 217-221). He was able to report that a greater degree of success had attended the efforts made during the early months of 1914 in comparison with the first trials in 1913. On the latter occasion the proportion of successes was 16 out of 40 or 40 per cent. During 1914 the percentage had risen to 65 and 67 in two successive batches budded, a distinct step towards the 75 to 80 per cent. mentioned earlier by Mr. Jones of Dominica as the desideratum if cacao budding is to be a practical success. Budding will be continued monthly through the year—in order to ascertain whether one season is more advantageous than another. The visitors inspected some 210 budded plants. Those which were done last September have made good growth and show promise of developing into well-shaped plants.

Mr. Augustus gave a practical demonstration of the process of budding and of the preparation of budding tape. Budded avocado pears were also shown and the attempts, unsuccessful so far, to bud the mango.

CACAO PRIZE COMPETITION.

A PEASANT PROPRIETOR'S RESULTS.

Mr. James Reid, a peasant proprietor in Manzanilla has addressed the following letter to Mr. L. A. Brunton, one of the Agricultural Inspectors, with the accompanying table showing his returns in the two years preceding the competition and the three subsequent years.

"Since I started with the competition which was opened by the Board of Agriculture to peasant proprietors, I found that the efforts made by me through your repeated visits and advice have been not only successful in keeping up the health of the plantation generally, but also its productiveness as compared with previous years.

"Attached is a sheet comparing the yield from two years previous to the Competition with the three years succeeding.

"The year 1911-12 when I was strongly advised by you to drain and to reduce my shade as much as possible (for which no time was lost in complying) I found that the trees responded immediately, and at the end of June 1912, I leaped above the average to the extent of 19 barrels. 1912-13 was no less satisfactory. This year 1914, is still more satisfactory than even 1912-13.

"I am to-day proud of being able to put before you a sketch, enabling you to see the benefits derived by me through the scheme, for which I have to thank you, and your Department.

COMPARISON OF YIELD FOR FIVE YEARS, *i.e.* TWO YEARS PRIOR TO COMPETITION AND THREE YEARS SUCCEEDING, ON "STA. BARBARA" ESTATE, PLUM ROAD, MANZANILLA.

Year.	No. of barrels picked.	Cured Cacao, lb.	Average weight per barrel, lb.	Cost of upkeep generally.	Drains in feet.	Remarks.
1909-10 ...	24	2,448	102	\$ 70.00 nearly	1,500	Insufficiency of drains, dense shade, etc.
1910-11 ...	26	2,640	102	\$ 70.00 ..	1,500	do.
1911-12* ...	43	5,100	118	\$165.00 ...	12,500	\$95.00 in excess for 2,460 lb. cured cacao. Shade removed.
1912-13 ...	45	5,340	118	\$110.00 ...	12,500	Drains did not clean but more shade removed.
1913-14 .	51	6,020	118	\$150.00 ...	12,500	All drains attended to. Round ridging etc., generally.

The Agricultural Inspector makes the following observations on this return :—

A study of this crop return discloses several interesting points that are worth emphasizing :

1. The increased yield commenced in 1911, the year of severe drought and has continued to advance during the succeeding very dry years.

2. The cultivation consists of 2,500 trees of which probably not less than seven per cent. are non-bearing.

3. No manure has been used and owing to difficulties of transport, etc., little if any mulching with material obtained outside of the cultivation.

4. The crop has risen from an average of 5.5 bags per 1,000 to 11.8 bags per 1,000 in the last three years.

5. Taking the value of cacao at ten cents per lb. the average yearly net cash return has risen from \$184 to \$407 during the past three years.

6. The average weight per barrel has increased by sixteen pounds.

* * Shade greatly reduced. 11,000 feet of drains in addition. Round ridging, etc., up to the present date under the Competition scheme.

"Therefore it is plain that 1914 has doubled itself and more, as compared with 1909-10 when practically nothing was done—and taking the aggregate expenses for 1911-12 (when the expenses were highest owing to new drains put in) the crop rose in proportion, *i.e.* from 2,650 lb. roughly at \$70.00 to 6,000 lb. at \$150, or in other words for a little more than twice the expenses to nearly three times the crop—No manure.

"The above does not include cost of supervision, which was done by myself.

"I forgot to mention that my plot only consists of 2,800 trees inclusively. My year is counted from July to June but as there is nothing more to be got of consequence, I close my countings as from Saturday May 9.

LIVE STOCK.

ENGLISH CATTLE TESTING STATION.

THE Government has received notification from the Secretary of State for the Colonies that a station has been established by the Board of Agriculture and Fisheries at Pirbright, Surrey, and is now available for the reception of cattle for the purpose of being tested for tuberculosis, or of being immunised against red-water, prior to exportation. The regulations under which cattle are received are contained in the following memorandum:—

MEMORANDUM AS TO APPLICATIONS FOR THE TESTING OF CATTLE FOR TUBERCULOSIS OR FOR THE IMMUNISATION OF CATTLE AGAINST RED-WATER PRIOR TO EXPORTATION.

1. The Board have provided a Testing Station with accommodation for 100 head of cattle at Pirbright, Surrey, for the reception of cattle for the purpose of being tested for tuberculosis, or being immunised against Red-water, prior to exportation abroad. The Board hope to provide further facilities as necessity arises, both as regards accommodation and also the tests and immunisation to be carried out at the Testing Station.

2. A fee of £6 per head will be charged for the tuberculin test, a fee of £5 per head for immunisation against Red-water, and a fee of £10 for the tuberculin test and immunisation combined. The fact that an animal has passed the tuberculin test or has been successfully immunised against Red-water will be certified under the seal of the Board.

3. The fees include all charges for testing or immunisation, for food and attendance during 31 days, and for conveyance between the Testing Station and Brookwood Railway Station (L. and S. W. Railway).

4. Payment of fees is to be made prior to the despatch of an animal to the Testing Station, by cheque, or by postal or money order, payable to the order of the Board of Agriculture and Fisheries and crossed Bank of England, and is to be forwarded to *The Secretary, Board of Agriculture and Fisheries, 4, Whitehall Place, London, S.W.* A form to accompany the remittance will be furnished by the Board, when notifying an owner that an animal can be received at the Station. The Board do not undertake to accept delivery of an animal until the fee for it has been received.

5. Owners are responsible for the carriage of animals by rail to Brookwood Railway station and thence after testing or immunisation to ports of embarkation.

6. Animals will be kept under observation at the Testing Station prior to the tuberculin test for 28 days, and the animal will be tested and available for removal after 31 days from the time of its arrival at the station, unless the test has to be postponed owing to some unforeseen circumstance. An animal received for immunisation only, will, in the ordinary course, be available for removal after 28 days. Animals should not be sent to the station for longer periods prior to shipment than will suffice for their being tested or immunised, as the case may be.

7. If an animal is kept for a longer period than 31 days at the Testing Station to suit the convenience of an owner, an additional charge at the rate of 30 shillings per week will be payable by the owner on demand by the Board, but if an animal is kept at the Testing Station for longer than 31 days owing to any unforeseen and unavoidable circumstances, this charge may be reduced by the Board.

8. Animals with respect to which Certificates of immunisation have been issued are to be moved from Brookwood Station by rail, in sealed vans if required by the Board, direct to the port from which they are to be exported.

9. Applications for the testing or immunisation of cattle should be made at least a month before the date on which it is proposed to send the cattle to the Cattle Testing Station. Forms of application can be obtained from the *Secretary, Board of Agriculture and Fisheries, 4, Whitehall Place, London, S.W.*

10. An undertaking is to be given that an animal which has been immunised will not be removed from the Testing Station except direct to the vessel on which it is to be exported.

11. The Board reserve power to refuse acceptance of an animal or at any time to return to the owner an animal if its retention in the Testing Station is, in the opinion of the Board undesirable for any cause.

12. Every animal sent to the Testing Station must be provided with a strong head-stall or halter, and notification is to be given in respect of any animal that has at any time proved to be vicious or dangerous.

13. Where more than one animal is consigned to the Testing Station by an owner each animal is to be marked for the purpose of identification by affixing an ear-tag or otherwise.

14. The animals whilst under the charge of the Board will be under the care and supervision of their Veterinary Officers but the Board shall not be liable, nor shall compensation be paid, for any loss occasioned by the death, slaughter, injury, or illness of an animal, or by an accident to an animal, whilst under their charge or subsequently.

15. The Board reserve power where they consider it to be necessary or desirable, to slaughter injured animals and dispose of their carcasses. The proceeds will be paid to the owner.

16. Should an animal re-act to the tuberculin test, it will be disposed of in accordance with the directions (if any) given by the owner on the application form. If no such directions have been given, the animal will be consigned at owner's risk and cost to the premises from which it was sent to the Testing Station.

17. For the purpose of identification every animal in respect of which a certificate is issued will be marked on the hoof or otherwise with a number by which the animal will be described on the certificate.

18. All communications should be addressed to *The Secretary Board of Agriculture and Fisheries, 4, Whitehall Place, London, S.W.*, except notifications as to the time of arrival of animals. The latter should be sent direct to *The Inspector in charge, The Cattle Testing Station, Pirbright, Surrey.*

REGULATIONS ON IMPORTATION INTO TRINIDAD AND TOBAGO.

The Colony has already a detention station for the testing of imported animals suspected of disease. In accordance with Ordinance No. 153, imported animals must be inspected; the charges for which are as follows:

I. On first inspection :—

For every horse or mule	...	...	£ 0 3 0
ass, bull, cow, ox, calf or dog	...	...	0 1 0
pig, sheep or goat	...	...	0 0 3

II. For certificate of non-infection—

(1.) In the case of a vessel in which any horse, mule, ass, bull, cow or ox is imported, if not more than five animals are imported ...	£0 5 0
If more than five animals are imported	0 10 0
(2.) In the case of a vessel in which no horse, mule, ass, bull, cow or ox is imported, if not more than five animals are imported ...	0 2 0
If more than five animals are imported	0 4 0

III. For every day on which animals in detention, (other than dogs) shall be visited by the Examiner ...	0 10 0
--	--------

IV. For Examiner's visits to a dog in detention (to be paid on landing) ...	0 10 0
---	--------

V. For certificate of freedom from disease after detention (for animals other than dogs)	1 0 0
--	-------

The above fees shall be paid to the Collector of Customs, with the exception of those under III. and V., which shall be paid to the Examiner of Animals.

The Governor in Executive Council has issued instructions that cattle, etc., imported with the certificate of the English Board of Agriculture will only be liable to inspection on arrival, for which the fees prescribed by the Ordinance will be charged, and such animals will not be detained or tested unless there are signs of actual disease amongst them.

THE FOOD VALUE OF STIZOLOBIUM PACHYLOBIUM BEANS.*

By HERBERT S. SHREWSBURY, F.I.C., F.C.S.

Acting Government Analyst.

A SAMPLE of beans grown on an estate in Trinidad was recently submitted to the Department, with a request for information as to its suitability for fodder, particularly with regard as to its possible toxic properties.

The beans were of a marbled appearance, with smoke coloured markings in irregular blurred streaks, patches and spots on a dirty white and rather dull back-ground. They were rather flat and measured about 19 x 18 x 6.5 m.m. The dirty white, oblong, crateri-form hilum measured about 8.5 m.m. The following examination was made on the whole meal obtained from the beans.

IDENTITY.

I am indebted to the Acting Director of Agriculture for the information that these beans are in all probability to be referred to the vine *Stizolobium pachylobium*. It will be possible to identify them with certainty when complete plants have been grown.

EXAMINATION FOR TOXIC PROPERTIES.

The beans of *Mucuna pruriens* are a violent aphrodisiac and those of *Stizolobium niveum* have caused vomiting and purging. Both these plants are closely related to *Stizolobium pachylobium*, the beans of which, however, have been used as fodder and also for human food without ill effects. Under the circumstances it seemed to be worth while further to confirm the non-poisonous nature of *Stizolobium pachylobium* beans grown in Trinidad.

No evidence was found of the presence of cyanogenetic or other poisonous glucosides, saponins, fats, alkaloids, vegetable ptomaines or toxalbumins.

Feeding experiments on guinea pigs fed with the whole meal from the beans, and with various solvent extracts of the beans, in which any poisonous substance from the bean meal would have been present in a highly concentrated form, gave entirely negative results. These experiments showed it to be highly improbable that the beans were toxic in the slightest degree.

TASTE, ODOUR, AND APPEARANCE OF FODDER.

The whole meal from the beans is a clean and pleasant cream coloured powder. Its taste and odour is pleasant and closely resembles that of pea meal.

* For the result of a similar investigation on the beans of *Stizolobium aterrimum* see Bulletin, XIII. June, 1914, pp. 194-5. (Ed.)

NUTRITIVE VALUE.

The table below compares the analysis of the whole meal with that of other beans :—

Kind of bean.	Carbo- hydrates.	Proteins.	Water.	Crude fibre.	Ash.	Fat.	Feeding Units.
Sample in question <i>Stizolobium pachylobium</i> (grown in Trinidad) ...	47.2	29.2	11.0	4.1	4.2	4.3	131
<i>Stizolobium aterrimum</i> (Bengal beans grown in Trinidad) ...	44.3	29.8	12.0	6.2	4.2	3.5	127
<i>Phaseolus vulgaris</i> (French Kidney bean) ...	52.7	23.1	13.6	4.8	3.5	2.3	116
* <i>Phaseolus lunatus</i> (Java or Lima bean) ...	† 67.1	15.9	11.1	...	4.1	1.8	111
<i>Vicia Faba</i> (Field or horse bean) ...	49.3	23.9	14.5	7.5	3.2	1.6	113
<i>Soja hispida</i> (Soy or Soja bean) ...	30.2	33.2	10.0	4.4	4.7	17.5	157

It will be seen that the sample is somewhat superior in feeding value to French, Lima or Java beans and that like these beans its nutritive properties are principally due to a high content of carbo-hydrates and proteins. Owing chiefly to its low percentage of fat, its value is considerably less than that of Soy beans.

It is interesting to compare the composition of beans from *Stizolobium pachylobium* and *Stizolobium aterrimum* both grown on the same estate in Trinidad in the same season. The two species yield beans which are almost identical in the quality and quantity of their constituent substances. *Stizolobium pachylobium* is slightly preferable, principally on account of its larger size. Since their skins testas are of a similar thickness the larger bean gives a meal containing a smaller quantity of indigestible crude fibre which is almost entirely derived from the skin.

TENTATIVE USE OF FODDER.

Caution is recommended in the use of these beans as a fodder, until their merits have been more firmly established.

Tentative feeding experiments should first be tried on animals of small value. Apparently innocuous fodders, e.g. beet, have been found to cause boils and other illness in cattle subjected to a too prolonged diet.

* Java beans contain a cyanogenetic glucoside and their inclusion in the table is not intended to indicate their desirability as a fodder.

† Includes crude fibre.

AGRICULTURAL EDUCATION.

AGRICULTURAL PUPIL COURSE.

AN examination was held in June to select the pupils for the first year's course at River Estate under the new scheme particulars of which were given in this *Bulletin* xiii. pp. 89-94. On this occasion the competition was restricted to pupils already with the Department, but next year it will be thrown open to any boys over sixteen years of age.

The successful candidates in order of merit were:—

			Marks
			(Total 260)
1. R. W. H. Leacock	...River Estate	...	220
2. Anthony Wood	...Botanic Station, Tobago		215
3. Clarence Webber	... Do.	do.	214
4. T. Boodansingh	...River Estate	...	207
5. A. T. Warner...	...Government Farm	...	205
6. Theodile C. Murray	...River Estate	...	200
7. A. V. Waddell	...Experiment Station	...	196
8. John Bishop ...	...River Estate	...	195
9. Edgar E. McKay	...Experiment Station	...	194
10. A. Cuthbert ...	...River Estate	...	161
11. Arthur Vigo ...	...Experiment Station	...	157
12. O. St. Rose ...	...River Estate	...	151

R. Leacock and Anthony Wood have been awarded the two Agricultural Exhibitions offered this year.

Work was begun on July 1, (the two pupils from Tobago actually arriving on the 3rd. On July 8 His Excellency the Governor, Hon. R. G. Bushe, C.M.G., (Chairman of the Board of Management of the St. Augustine and River Estates), Mr. W. G. Freeman, (Acting Director of Agriculture), Mr. J. de Verteuil (Acting Assistant Director), Mr. J. C. Augustus (Superintendent of River Estate) and Mr. R. O'Connor (Manager of River Estate) were present and inspected the arrangements, and spoke with the pupils on the work before them. A syllabus of the course of instruction is being drawn up and will be published shortly. The pupils spend the greater part of their time in practical estate work but on two afternoons each week receive instruction in the class room according to the programme laid down in the published scheme.

Those of the pupils whose homes are not in the neighbourhood of the estate are provided with sleeping accommodation, and a room for meals, &c. All are paid according to the value of their work to the estate and are thus able to maintain themselves.

PUBLICATIONS RECEIVED.

A course of Practical Work in the Chemistry of the Garden (By D. R. Edwards Ker, pp. 1-40—John Murray—Price 1s. 6d. London 1914).

As announced on the title page—this is an elementary handbook for teachers, and students of horticulture, gardening, and rural science—a larger work by the author and Dr. S. J. M. Auld, being intended for more advanced students. The various chapters deal with the chemistry of plants, soils, manures and fertilizers and lastly of sprays and washes. The experiments outlined are simple and concise and in a useful appendix directions are given for making the special re-agents mentioned in the text; the preparation of soda lime might very well have been included among these.

In experiment 7, dealing with colour re-actions for recognizing proteins, the simple test with Millon's re-agent is omitted and the more elaborate xanthoproteic and Adamkiewicz's re-actions given. In the examination of basic slag, attention is called to its alkalinity, "*A condition due to the presence of free lime*"; A good sample of basic slag does not however contain more than 2 per cent. of free lime; the total lime there being in loose combination as a silicate and also basic phosphate of calcium and possibly as a loosely combined double salt, silicate and phosphate.

The usual paraffin (or kerosene) sprays prepared with soft soap are given. It would be well to supplement them with the lysol kerosene mixture (2 parts lysol, 6 parts kerosene and 100 parts water) which is extremely easy to make and is very permanent in character besides being fungicidal, and its cheaper modification—beta lysol mixture—in the same proportion—but using "Homeight" brand of kerosene or Tabaquite burning oil. Beta lysol costs about 4s. 2d. (\$1) per gallon while ordinary lysol costs 2s. 6d. per pound.

The work is an excellent elementary text book for the purpose stated above, and experience will easily suggest additional or modified experiments more closely adapting it for tropical work.

A. E. C.

Elementary Tropical Agriculture. (By W. H. Johnson, pp. XII and 150; Crosby Lockwood & Son. London. 1913. Price 3s. 6d.)

The scope of this book is very similar to that of *Nature Teaching*, which is well known in the West Indies, and any one who turns to it for instruction in tropical agriculture will be disappointed. This is not an adverse criticism of the book, but of its title. The volume affords information, illustrated by tropical examples on the soil, the functions of the parts of a plant, some diseases and pests, weeds and school gardening. It is specially written for West African conditions and as a handbook for instruction in schools on the principles underlying agricultural practice it should prove of service; it is well produced and contains clear and useful illustrations.

W. G. F.

The Timbers of British Guiana. (By Herbert Stone and W. G. Freeman, pp. XII and 110. Published for the Government of British Guiana by the Crown Agents for the Colonies. London. 1914. Price 5s. net.

"The purposes of the present book are to provide a description of the wood of each species of tree present in the collection made in British Guiana, under the superintendence of the Hon. A. G. Bell, M. Inst. C. E., sometime Colonial Civil Engineer; to identify the species as far as possible and to refer them to their systematic position, to collect any information concerning these species that may already have been published: to record the results of tests made upon the woods by means of tools commonly used in the conversion of timber and to report upon their commercial utility with special regard to their prospect of gaining a footing in the English market."

Ninety-seven timbers are fully described as regards their physical characters, uses, qualities, and anatomical characters. Their native names are given, supplemented when obtainable by the botanical names also.

W. G. F.

NOTES.

The leave of Professor Carmody the Director of Agriculture has been extended for three months from July 28, 1914.

The Department has received a letter from the Consul for Nicaragua at Trieste, Austria stating that high prices are paid in Vienna and other places in Austria for high class and very large beaned coffee and that he would be glad to know of any firms who care to take up the exportation of such coffees to Austria.

The medals and prizes gained in the Cacao Prize Competition 1913-14 were distributed by His Excellency the Governor at Planagin Town on June 13, and at Santa Cruz on July 11.

The date of entry in the Cacao prize Competition 1914-15 has been extended to August 31.

A price list of nursery stock usually available has been published as *Circular No. 17*. It is a reprint, with a few alterations, of the list which appeared in this *Bulletin* for March-April, 1914. Copies can be obtained at the Head Office, at St. Clair Experiment Station, or at the Botanic Station, Tobago.

Special Circular No. 10, "Breeding and Colonizing the Syrphid" by Mr. P. L. Guppy has been issued and distributed to the Sugar estates. It is reprinted in this issue of the *Bulletin*.

METEOROLOGY.

RAINFALL RETURN FROM JANUARY TO JUNE, 1914.

Stations.	June 1914.	Jan. to June 1914.	June 1913.	Jan. to June 1913.
<i>North-west District.</i>				
	Inch.	Inch.	Inch.	Inch.
St. Clair—Royal Botanic Gardens ...	7.34	12.79	2.80	9.73
Port-of-Spain—Colonial Hospital ...	6.58	11.03	2.77	7.55
" Royal Gaol ...	6.20	11.35	3.40	9.84
" Constabulary Hdqrs. ...	6.51	12.60	3.37	9.35
St. Ann's—Reservoir ...	6.38	12.21	4.50	12.15
Maraval— ...	6.85	14.39	4.31	13.64
" Constabulary Station ...	7.53	15.21	6.83	17.29
Diego Martin—Constabulary Station ...	6.33	14.65	5.98	15.88
" Waterworks ...	5.89	13.94	5.82	15.61
" River estate ...	5.88	14.11	6.05	15.66
Fort George Signal Station ...	6.98	14.99	4.59	12.19
North Post ...	5.69	11.89	5.65	13.10
Carenage Constabulary Station ...	10.42	20.68	6.54	15.78
Carraim Island Convict Depôt ...	7.31	11.96	3.16	8.34
Chacachacare Lighthouse ...	6.03	14.16	6.36	12.98
<i>Santa Cruz—Maracas District.</i>				
Santa Cruz—Constabulary Station ...	8.56	15.09	5.79	17.50
St. Joseph—Government Farm ...	7.12	14.85	5.13	13.50
" Constabulary Station ...	6.53	13.02	4.51	11.05
Tunapuna—St. Augustine estate ...	6.24	14.22	5.30	11.34
Maracas—Government School ...	8.61	15.82	4.85	17.96
" Ortínola estate ...	7.61	16.24	5.03	17.62
Caura—Wardour estate ...	7.07	11.26	4.76	9.30
<i>West Central District.</i>				
Caroni—Frederick estate ...	20.64	39.87	12.50	34.91
Chaguanas—Constabulary Station ...	9.75	16.65	7.65	18.37
" Woodford Lodge estate ...	9.39	17.21	7.08	17.38
Carapichaima—Waterloo estate ...	8.04	16.70	9.04	19.81
" Friendship Hall estate ...	8.55	18.67	8.14	20.73
Couva—Exchange estate ...	6.91	11.31	5.42	13.02
" Brechin Castle estate ...	8.90	15.01	7.15	16.91
" Perseverance ...	8.88	16.32	5.73	14.15
" Camden ...	7.56	11.89	5.27	17.31
" Milton ...	9.90	14.23	6.71	15.34
" Spring ...	9.74	15.29	6.57	19.07
" Constabulary Station ...	9.50	15.52	7.16	13.91
" Esperanza estate, Savonetta ...	7.62	12.63	5.80	14.64
<i>San Fernando & Princes Town District.</i>				
Claxton's Bay—Forbes Park estate ...	6.31	10.89	4.80	13.77
Pointe-à-Pierre—Bonne Aventure est. ...	9.24	16.15	8.23	19.88
" Concord estate ...	10.05	16.84	7.35	19.67
" Plein Palais estate ...	8.52	12.29	8.25	17.77
Naparima—Picton estate ...	5.95	12.97	4.01	11.54
" Usine St. Madeleine estate ...	8.42	14.90	11.22	23.23
" La Fortitude estate ...	5.56	11.56	5.31	14.44
" Lewisville, San Fernando ...	9.50	16.47	9.89	22.25
" Tarouba estate ...	5.93	9.34	6.45	13.91
" Union Hall ...	6.70	13.37	7.52	16.35
" Palmita ...	8.15	13.91	6.56	15.61
" Hermitage ...	6.41	13.59	4.89	13.60
Princes Town—Craignish ...	11.42	20.03	7.79	19.07
" Cedar Hill estate ...	9.59	18.09	8.77	18.70
" Williamsville estate ...	9.64	17.97	7.79	19.91
" Esneralda Estate ...	10.01	18.93	9.75	23.47
" New Grant estate ...	11.66	22.50	6.97	20.36
" Constabulary Station ...	7.48	11.84	7.05	17.62

RAINFALL RETURN FROM JAN., TO JUNE, 1914.—CONTD

Stations.	June, 1914.	Jan. to June, 1914.	June 1913.	Jan. to June, 1913.
<i>San Fernando and Princes Town District. —(Cont'd.)</i>	Inch.	Inch.	Inch.	Inch.
Princes Town—Hindustan estate	10.99	19.78	6.92	19.09
„ La Retraite estate	16.03	32.35	11.93	29.28
„ Madgretoute estate	10.98	18.62	8.85	19.52
Savana Grande—Friendship and Ben Lomond estates	8.96	15.69	7.22	17.17
Poole—El Rosario estate	15.57	26.93	9.96	32.13
<i>Montserrat District.</i>				
Montserrat Constabulary Station	9.53	16.63	7.83	20.21
Brasso—La Vega estate	11.98	21.49	10.25	24.81
<i>Arima District.</i>				
Arima—Warden's Office	10.01	17.21	6.30	14.94
„ Torrecilla estate	12.01	26.46	9.40	23.82
„ Verdant Vale estate	11.43	23.83	9.30	23.45
San Rafael—Constabulary Station	11.68	29.36	11.16	28.00
Guanapo—Talparo estate	13.02	23.99	10.43	25.93
„ San José Estate	13.42	—	—	—
Tamana—Sta. Marta estate	15.10	30.74	11.68	32.37
<i>South-west District.</i>				
Oropuche—Constabulary Station	8.06	20.03	6.49	17.61
„ Pluck estate	5.79	13.30	6.28	14.60
Siparia—Constabulary Station	7.92	20.79	7.30	23.88
Guapo—Adventure estate	6.37	15.85	4.01	14.37
Cap-de-Ville—Constabulary Station	10.80	22.71	5.54	23.02
Erin—La Ressource estate	10.88	19.27	9.12	22.31
„ Industry estate	12.03	21.62	—	—
Cedros—Constabulary Station	8.74	18.61	5.11	16.04
„ Perseverance estate	9.08	16.45	—	—
Icacos—Constance estate	6.38	10.19	3.90	15.72
Trois—Trois estate	10.14	21.28	4.86	19.23
<i>South Coast.</i>				
Moruga—Constabulary Station	6.85	11.41	5.41	20.13
<i>North Coast.</i>				
Blanchisseuse—Constabulary Station	11.04	21.40	10.41	33.77
Grande Rivière—Mon Plaisir estate	9.49	28.76	12.35	42.10
Toco—Aragua House	11.53	21.36	9.38	31.52]
„ Constabulary Station	9.80	19.95	9.80	31.25
Point Galera—Light House	5.55	10.56	7.64	16.66
<i>East Coast.</i>				
Matura—La Juanita estate	12.41	25.25	11.75	36.40
Manzanilla—Constabulary Station	13.16	24.86	10.27	31.14
Sangre Grande—Sta. Estrella estate	11.18	29.43	10.25	34.47
„ New Lands estate	10.81	25.72	10.38	36.11
„ Evasdale estate	12.88	30.83	12.31	33.50
„ Grosvenor estate	11.57	26.82	11.36	31.87
Mayaro—Constabulary Station	8.32	17.33	8.01	25.51
<i>Tobago.</i>				
Tobago—Hermitage estate	6.74	20.48	9.68	29.39
„ Riversdale	4.85	11.06	6.54	18.61
„ King's Bay	6.21	18.89	8.40	25.81
„ Roxburgh	8.23	23.24	7.85	29.70
„ Lure estate	10.47	25.84	8.84	28.70
„ Botanic Station	6.61	14.37	6.19	15.94
„ Government Farm	3.41	6.45	3.95	10.54
„ Lowlands estate	5.96	10.43	6.06	15.07
„ Friendship estate	6.04	13.29	4.94	14.79

(Bulletin, Department Agriculture, Trinidad & Tobago, pp. 217-247. Issued July 31, '14).

BULLETIN


OF THE
DEPARTMENT OF AGRICULTURE,
Trinidad and Tobago.

Vol. XIII.]

AUGUST-OCTOBER, 1914.

[No. 83.

CURRENT EVENTS.

 WING to the pressure of other duties which arose in consequence of the war it proved necessary to suspend temporarily the monthly issue of the *Bulletin* and the present number is for the three months August, September and October; after this issue the usual time of publication will be resumed. It will be of interest to place on record the action taken in various directions to cope with the special conditions, so far as regards agricultural matters, created by the war.

PRICES OF FOODSTUFFS.

One of the immediate results of the outbreak of hostilities was a rise in the price of imported and other foodstuffs. In order to check this His Excellency the Governor appointed a Committee, under the Chairmanship of the Hon'ble H. C. Gollan Attorney-General, which, amongst other matters, fixed retail prices. The first schedule issued established uniform prices throughout the Colony, but as this resulted in hardship to retailers in remote districts, who naturally had to bear charges for freight from Port-of-Spain, the schedule was revised and the following substituted :—

PRICES IN SHOPS WITHIN TWO MILES OF A RAILWAY STATION OR OF A COASTAL STEAMER DEPÔT.

- Biscuits (Middies)—not less than 5 for 1 cent.
- Bread—not less than 3 ounces for 1 cent.
- Cornmeal—not more than 4 cents per pound.
- Rice— not more than 6 cents per pound.
- Flour (brown)—not more than 4 cents per pound.
- Flour (white)—not more than 5 cents per pound.
- Saltfish—not more than 12 cents per pound.
- Salt Beef—not more than 15 cents per lb. .
- Kerosene Oil—not more than 7 cents per reputed quart bottle.
- Milk—not more than 15 cents for 1 lb. tin.
- Lard Substitute—not more than 16 cents per lb. if sold in tins
or 14 cents per lb. if sold otherwise than in tins.
- Oleomargarine—not more than 14 cents per pound.
- Sweet Oil—not more than 32 cents per bottle.
- Fine Salt—not more than 2 cents per lb.
- Sugar (No. 2 Usine)—not more than 5 cents per lb.
- Sugar (No. 3 brown)—not more than 4 cents per lb.
- Split Peas—not more than 4 cents per pound.
- Dholl—not more than 4 cents per lb.
- Salt Pork—not more than 15 cents per pound.

ELSEWHERE.

Biscuits (Middies)—not less than 4 for one cent.
 Bread—not less than 3 ounces for one cent.
 Cornmeal—not more than 4 cents per pound.
 Rice—not more than 6 cents per pound.
 Flour (brown)—not more than 4 cents per pound.
 Flour (white)—not more than 5 cents per pound.
 Saltfish—not more than 13 cents per pound.
 Salt Beef—not more than 16 cents per pound.
 Kerosene Oil—not more than 7 cents per reputed quart bottle.
 Milk—not more than 15 cents for 1 lb. tin.
 Lard Substitute—not more than 16 cents per pound if sold in tins,
 or 14 cents per pound if sold otherwise than in tins.
 Oleomargarine—not more than 14 cents per pound.
 Sweet Oil—not more than 32 cents per bottle.
 Fine Salt—not more than 2 cents per pound.
 Sugar (No. 2 Usine)—not more than 5 cents per pound.
 Sugar (No. 3 brown)—not more than 4 cents per pound.
 Split Peas—not more than 4 cents per pound.
 Dhol—not more than 4 cents per pound.
 Salt Pork—not more than 15 cents per pound.

(Sgd.) S. W. KNAGGS,

Colonial Secretary's Office,
 September 5, 1914.

Colonial Secretary.

SUPPLIES OF GROUND PROVISIONS.

Closely connected with the question of imported foodstuffs was that of the supplies of ground provisions. The Colony in normal times receives considerable imports of ground provisions— which term includes sweet potatoes, yams, tannias, eddoes, &c.—from Barbados, St. Vincent, Grenada and Venezuela.

Barbados early passed an Act absolutely prohibiting the export of foodstuffs under penalties of imprisonment or a fine of £500. Saint Vincent and Grenada discontinued supplies wholly or in part, as also did Venezuela, one district of which issued a notice the following translation of which was communicated to the Government of this Colony by the Bermudez Company, Port-of-Spain:—

OFFICIAL NOTICE.—The Municipal Council has resolved to have the Civil Authority of the District take stern and effective steps towards forbidding the exportation of corn, plantains, tannias and all kinds of cereals to other districts, these measures being adopted as precautionary steps to avoid possible future famine that may fall in lot to these towns.

The Civil Authority hereby absolutely forbids from to-day the exportation of the above mentioned produce throughout its jurisdiction until further notice by the District Council.

Yrapa, the 14th August, 1914,

The Civil Authority,
 (Jefe Civil).

(Sgd.) J. D. GUTIERREZ.

(Sgd.) L. A. VETTENCOURT.
 Secretary.

His Excellency the Governor appointed a Committee to deal with the general question of the supply of ground provisions. This Committee consists of Mr. W. G. Freeman (Acting Director of Agriculture), Chairman; Hon'ble W. G. Kay, Messrs. A. B. Carr, A. V. Stollmeyer, F. Herrera, E. M. Lazare and G. C. Wyatt. Some of the measures taken to encourage the production of provisions are indicated in the following communication from the Committee which was kindly published by the *Port-of-Spain Gazette* and the *Mirror* on September 11.

THE SUPPLY OF GROUND PROVISIONS.

An Appeal to all Inhabitants of the Colony.

The Committee appointed by His Excellency the Governor to deal with the local supply of ground provisions, has already, through your courtesy and in other ways, asked all inhabitants of Trinidad and Tobago to assist, in whatever way is in their power, in encouraging the production of ground provisions.

One immediate result of the war has been to stop entirely or in part the supplies usually received from Barbados, Saint Vincent, Grenada, Venezuela, &c. Other imported foods have also gone up in price, so that both now and so long as the effects of the war last (which may well be for many months) the Colony will be dependent, to a greater extent than usual, on its own resources for foodstuffs.

By the efforts of the Clergy of various denominations, the Press, many planters and other private persons, the Port-of-Spain Corporation, the Wardens, the Department of Agriculture and some of the District Agricultural Societies there is already much activity in various districts, and quickly maturing crops such as sweet potatoes, beans, &c., have been and are being extensively planted. The ordinary crops—corn, potatoes, cassava, tannias, eddoes, and rice—are ripening, and given favourable weather there appears reasonable hope that moderate supplies will soon be available for immediate requirements. Much however depends on the weather which in several districts has been anything but favourable.

In order to ascertain the general position in the Colony, the Committee has obtained information from all the Wardens, which shows that whilst there are a very few wards in which the present and prospective supplies are now, as always, insufficient to meet the local demand, and others in which they are so temporarily due largely to the recent drought, there are a few in which the immediate supplies are larger than required locally.

The Committee is organising a method of bringing these surplus supplies to the ordinary markets, and with financial assistance from the Government will put it into operation shortly. It is intended to provide means of transport and to purchase for cash on the spot provisions in districts so remote from railways, &c., that the produce does not usually find its way to the markets.

Advertisements have appeared in the papers offering lands on special terms for provision cultivation, e.g. those of the Port-of-Spain Corporation, Hon'ble A. de Boissière, and Mr. Mathison. Estates can assist by granting their labourers and others small plots of land, free for provision gardens. According to reports in the Press this has been done by Orange Grove Estate 200 acres, by Mr. R. Rust 100 acres, Caroni Sugar Estate

at least 50 acres, Mr. A. B. Carr at Caparo 20 acres, Mr. W. H. Mills about 180 acres. Similar offers are being made in other places in both Trinidad and Tobago. Many estates can doubtless help in a similar manner, and the Committee hopes that all who can will do so. Information has just come to hand that Tennants' Estates have offered land on very liberal terms particulars of which will be published later.*

On many sugar estates a crop of sweet potatoes could be raised amongst the young canes; this is of course nothing new in this suggestion but special encouragement to do so might be given now. Of still greater value however, would be the determination of all in the Colony who have any land, even merely a very small area around their houses, to plant food crops for their own use. Each individual effort may be small, but the total result throughout the Colony would be very great. The Committee feels that a universal effort of this character would go further towards relieving anxiety than any other measure it can suggest. If a large number of householders, be they large or small, have each their own little plot of such plants as sweet potatoes, yams, tannias, eddoes, cassava, beans, &c., they will free themselves from anxiety and also by reducing the demand in the markets assist in keeping down prices to normal levels. Those who have more land available than necessary for their own requirements will be able to assist others not so fortunate.

It should be the aim of every one to become, if possible, a producer instead of merely a consumer. Many people have already realised this and are acting upon it. The Committee hopes that all who have influence over others will help them to see and act upon it too.

In a country such as this the people can do much to help themselves; they will reap direct benefits personally and the aggregate effect will be to place the whole community in a better position. There are some who must remain consumers only, but a little effort will result in these being a much smaller proportion of the community than at present, resulting in lessened demand, and if the demand in the markets for provisions can be substantially reduced prices are bound to remain lower than would otherwise be the case.

Another matter is the prevention of any waste of existing supplies. There are areas in which there is bitter cassava in excess of immediate requirements. In some tropical countries, *e.g.* in parts of South America cassava is the staple food, and is stored in the form of farine or cassava meal, which keeps good for several months. In this Colony cassava farine although largely used is not usually made for storing. Conditions are different now and any spare cassava might well be converted into farine and stored. Mr. Brunton has reported available stocks near Siparia and it is hoped that in that neighbourhood enterprise will be forthcoming to establish a buying centre and manufacture farine. The Warden of Tacarigua also reports surplus supplies at Blanchisseuse.†

Bananas may also be available in larger quantity than usual. The temporary stoppage of the export of fruit, due chiefly to unsettled conditions in England disorganising the usual steamer arrangements, with possible loss of the consignments of perishable products, means

* See p. 254.

† For directions for making farine, see p. 277. —(E1.)

so long as it continues that there will be in the Colony some 10,000 bunches each month more bananas; this being the number usually exported. Bananas are well known as a wholesome and nutritious food, and all classes could use more than usual to lessen the consumption of other foods. Unripe bananas also yield a useful meal if peeled and sliced (with nickel knives or sharpened bamboo sticks), dried in the sun for two or three days and powdered and ground. Such meal or flour is made in Jamaica, &c., and forms a useful food which if kept dry will remain good for a long time. The Agricultural Society of Jamaica has advised a greater preparation of banana meal, and this Colony should do the same.

The question of giving advances on ground provisions has been considered. Sugar estates which give advances on canes could scarcely be expected to provide large sums for provisions which are not crops necessary to the working of the estate. It would mean the provision of additional working capital for purposes other than that of the estate proper. Government advances are difficult to arrange for as the machinery necessary to provide for inspection, &c., is lacking, and the security afforded by the cultivator undertaking to sell his canes to a particular factory would also be absent. It may be noted however, that the report of the Agricultural Banks Committee will be presented at to-day's meeting of the Agricultural Society; if adopted and the necessary legislation be enacted soon, it would be possible for cultivators to get advances for provision cultivation through a bank.* Such advances or loans would be quite legitimate business for local agricultural banks of the type which are being recommended under the safeguards they afford.

The essential point now is to encourage people of all classes to do a little in their own interest. The net result of many small efforts will be to the great advantage of the community as a whole.

OFFERS OF LAND.

It is difficult to say exactly to what extent the various offers of land for the growing of provisions have been taken up. In some cases at any rate the results have been disappointing. One reason alleged is the fear of prædial larceny; this it is hoped will disappear as the result of the Government notice giving information that special attention will be devoted to this class of offender. On the other hand in some cases there has been a ready response. The Port-of-Spain Corporation offered to rent for a period of sixteen months land at Woodbrook in (a) eighth of an acre lots at \$1.00, (b) acre lots at \$8.00

The total area thrown open was 75 acres and the greater portion was quickly taken up.

As an instance of another considered scheme that adopted by Tennants Estates, Ltd., may be cited. Particulars are given in the following letter from Mr. D. C. Ince, Manager of Malgretout to the Warden of Princes-Town.

* The report was adopted, see p. 287.—(ED.)

MALGRETOUT,

September 5, 1914.

DEAR MR. JARDINE,

Will you kindly let the people know that I have obtained Mr. Moodie's consent to give out lands to any approved person sent by you, for the purpose of planting provisions under the following conditions :

1. One-eighth or one-quarter *quarree** of land will be given to one person, wherever allotted by the estate for the purpose.

2. Provisions: cassava, potatoes, etc. to be planted in the banks, and cane in the drills not later than November 30, 1914.

3. No rent to be charged until July 1, 1915, from this date the rent will be at the rate of \$6.00 per *quarree*, to be paid from the cane crops 1916, and a rebate of rent of \$1.00 for every 10 tons of cane, delivered to the factory, will be given.

4. In case any one takes land, and does not work it to the satisfaction of the estate authorities—of which the latter shall be the sole judges—they (the estate authorities) shall have the power to take possession of the same land at twenty-four hours notice to the occupier.

5. Cane plants will be given, and every help will be lent to get potato cuttings, if obtainable, at the actual cost of delivering them, to be paid for out of crop 1916.

6. Anyone desirous of taking land must sign a paper agreeing to the above conditions. The reason that no rent is charged to July 1, 1915 is to encourage the people to plant provisions as a start, and after July 1, 1915 rent is charged so as to make the labourer industrious, and to let him realise that the non-payment of rent solely depends on his own exertions, as the rebate of rent is fixed on such terms that any labourer can always get the rent free, if he works his land well, and shows the industry he should.

If the provision and cane crops are well looked after, the provision crops should yield nearly as much as to give a large portion if not all, of the cane crop free.

I trust that the labourers in the district will avail themselves of this offer to help to supply provisions for the use of the inhabitants of this island, and especially of this district, and thus show that they are helping the Empire in just as loyal a way by providing the necessary food, as others are by going to the front in this terrible struggle by the Empire for "LIBERTY, JUSTICE, and CIVILISATION."

Yours very truly,

(Sgd.) D. C. A. INCE.

At St. Augustine Estate some fifty acres is being planted in emergency crops, and smaller areas similarly dealt with at St. Clair Experiment Station, Government House Gardens and at the Botanic Station and Government Farm, Tobago.

A *Quarree* is a Spanish measure for land and equal $3\frac{1}{2}$ acres.—(Ed.)

RENTING OF CROWN LANDS.

The Government also received a considerable number of applications for areas of Crown Lands on the principle of deferred payments. These were carefully considered with the result that the Government was advised to rent to approved applicants any Crown Lands on which there is no timber, but suitable for provision cultivation, in lots not exceeding two acres at the nominal rental to be paid in advance of two shillings per acre for a period of two years, with option of renewal for a further period of one or two years.

The Government has adopted this suggestion and the necessary instructions have been issued to the Wardens to whom applications for such lands should be made.

The following is the authorized form of Agreement:—

TRINIDAD.

Agreement made this day of 1914, between the Warden of acting herein for and on behalf of the Government, hereinafter called the Landlord, of the one part, and of in the said Island of Trinidad, hereinafter called the Tenant, of the other part.

The Landlord agrees to let and the Tenant agrees to take that parcel or lot of land situate in the Ward of containing and bounded on the North on the South on the East on the West

for a term of two years from the day of 1914, upon the terms and conditions hereinafter appearing, and subject to the payment of 2/- per acre upon the execution hereof, and subject to the sooner determination of the tenancy in manner hereinafter expressed.

1. The Tenant shall in a proper and husbandlike manner to the satisfaction of the Landlord plant and cultivate the whole of the said parcel of land in ground provisions, rice, corn, peas, vegetables and other kindred quick growing crops suitable for human consumption.

2. The Tenant shall not build or erect on the said lands any building or structure whatever except tool sheds and shelters.

3. The Tenant shall not sub-let the said land or any part thereof without the consent in writing of the Landlord.

4. The Tenant shall keep the said land in a proper sanitary condition and shall obey all orders of the Sanitary or other Authorities.

Notwithstanding anything herein contained it shall be lawful for the Landlord at any time upon breach by the Tenant of any of his covenants hereinbefore contained by fourteen days notice in writing to determine this Agreement without paying or being liable for any refund of rent or compensation of any kind whatsoever in respect of crops so planted being on the said land.

The Tenant observing and performing all and every his covenants aforesaid, may at the expiration of the term hereby granted obtain a renewal thereof for a further period not exceeding two years upon such terms as may then be agreed upon.

Warden.

Tenant.

Witness.

ADVANCES TO ESTATES.

Another difficulty which arose was that of the possibility of labourers on estates being thrown out of employment owing to owners finding it impossible in the exceptional circumstances to finance their properties. This matter has been dealt with as indicated in the following Government notice.

GOVERNMENT HOUSE,

August 15, 1914.

The Government is prepared, in order to avoid as far as possible labourers being thrown out of employment under existing conditions, to make advances to planters to meet their paysheets in cases in which the inability to meet them otherwise can be satisfactorily established.

These advances will be made a first charge on the estate and the produce thereof, by an ordinance to be introduced for the purpose, and will be subject to interest at a rate not less than that ruling for such advances elsewhere nor less than a rate which will reimburse the Government for all expenses in connection therewith.

Applications in the form attached should be addressed to the Auditor-General Audit Office, Port-of-Spain.

By Command,

S. W. KNAGGS,
Colonial Secretary.

(No. 227.)

*Application for an Advance from Public Funds to the Estate
situated in the Ward of*

1. Owner.....
2. Property (Name, acreage, and No. on Assessment Roll)....
3. Encumbrances (To state Mortgagees, and amounts of Mortgages).....
4. Labour employed (Average of pay-lists per year for 3 years 1911-13).....
5. Crop (Average for 3 years 1911-13).....
6. Reason for application (The method under which the estate has
been hitherto carried on and reason for discontinuance must
be clearly stated).....
7. Advances applied for (Amounts and dates).....
8. Signature of Applicant (To state whether owner, manager or
attorney).....

GIFTS TO THE MOTHER COUNTRY.

In addition to private subscriptions, *e.g.*, the Patriotic Fund collected under the auspices of the Chamber of Commerce, and the Red Cross Society's Fund, the Colony by a vote of the Legislative Council offered a gift of £40,000 in aid of the war, which will be sent as cacao. Amongst other West Indian Colonies which are similarly contributing agricultural products are Barbados £20,000, British Guiana £20,000, Jamaica £50,000 and St. Kitts Nevis £5,000 as sugar in each case: Grenada £10,000 part as cacao, St. Vincent £2,000 as arrowroot. A Committee has also been formed in Trinidad to send gifts of oranges and other fruit to wounded sailors and soldiers; the first consignment was despatched on October 27.

W.G.F.

SUGAR.

RESULTS OF VARIETAL TESTS OF SEEDLING CANES GROWN AT ST. AUGUSTINE AND RIVER ESTATES DURING THE SEASON 1912-1914.

BY J. DE VERTEUIL, F.C.S.
Superintendent of Field Experiments.

A.—ST. AUGUSTINE ESTATE.

The canes grown at St. Augustine consist of plants and first ratoons. The soil in the fields planted may be described as a light loam. Plant canes receive an application of pen manure at the rate of 20 tons per acre. No manures are applied to ratoons and in every case the canes receive the ordinary estate's cultivation.

The canes were sampled in the same manner as last year, that is shoots and green canes are included.¹

The analysis of the juice was made between April 21 and May 5, 1914 and during this period 2·14 inches of rain were registered on the estate.

Table I gives the results obtained from the plant canes in Fields 7 and 8 and as these were planted in June 1912 they were about 22 months old at the date of analysis. The area under cultivation for each variety varies from 4,750 to 11,000 square feet, except in the case of the Bourbon and Badilla varieties which occupied an area of slightly more than $\frac{1}{2}$ and $1\frac{1}{4}$ acre respectively.

From Table I it will be seen that several new varieties imported from Barbados have been tried for the first time at St. Augustine. Of these B. 6835 and B. 4578 have given better results than the Bourbon, which gave an indicated yield of 3·13 tons of sugar per acre and this is a good return for plant canes of this variety. B. 3922 with a yield of 2·97 tons of sugar is also a promising new cane.

The results from the first ratoons in Field 5 and from the experiment plots are recorded in table II, whereas table III gives the results of these same canes as plants and first ratoons. The average results for the two years are also recorded in this table.

1. *Vide* report "Minutes of the Board of Agriculture, May 16, 1913.

TABLE
Plant Canes—Fields 7 and 8—St. Augustine Estate.

Canes.	Date planted.	Area under cultivation.	JUICE.					YIELD PER ACRE.		
			Per cent extracted.	Specific gravity.	Brix.	Percentage of		Sugar per gal.	Cans.	Juice.
						Su- crose.	Glu- cose.			
		Sq. ft.							Tons.	Galls.
Badilla	June, 1912	78,750	62.9	1.0873	20.9	18.20	0.90	87.1	44.27	5,737
B. 6835	"	4,750	63.7	1.0850	20.4	18.34	0.93	89.9	36.41	4,939
B. 7169	"	4,750	68.4	1.0753	18.2	15.89	1.12	87.3	39.80	5,671
T. 75	"	4,750	62.3	1.0753	18.2	15.23	1.38	83.7	43.65	5,665
D. 116	"	9,500	67.0	1.0775	18.7	15.42	1.30	82.5	36.86	5,134
B. 376	"	4,750	65.9	1.0753	18.2	16.23	0.76	89.2	33.47	4,595
B. 3412	"	4,750	64.4	1.0722	17.5	14.28	1.07	81.6	37.96	5,107
D. 109	"	9,500	68.7	1.0753	18.2	15.21	1.73	83.6	32.88	4,705
D. 115	"	5,390	65.7	1.0819	19.7	17.48	0.94	88.7	30.22	4,111
B. 4578	"	4,750	70.3	1.0730	17.7	14.27	1.55	81.7	33.10	4,858
B. 6450	"	4,750	69.5	1.0682	16.6	14.06	1.07	84.7	32.19	4,691
Bourbon	"	24,050	66.8	1.0739	17.9	15.38	1.12	85.9	30.46	4,244
B. 208	"	9,500	67.2	1.0810	19.5	17.49	1.22	89.7	26.09	3,633
B. 3922	"	4,750	66.1	1.0775	18.7	16.34	1.12	87.4	27.51	3,780
B. 3390	"	4,750	67.5	1.0735	17.8	14.90	1.50	83.7	27.60	3,897
B. 3859	"	4,750	64.6	1.0717	17.4	14.10	1.67	81.0	28.06	3,789
B. 16832	"	4,750	68.6	1.0691	14.5	10.92	1.33	75.3	33.38	4,643
T. 39	"	11,000	69.8	1.0735	17.8	14.46	1.50	81.2	23.44	3,414
T. 202	"	7,000	63.7	1.0801	19.3	16.93	0.96	87.7	19.35	2,556

* The figures given in these columns were obtained from the Manager of St. Augustine estate.

The results obtained from the first ratoons are good and exceed, in several instances, those obtained last year as plant canes *vide* table III. These canes were about 12 months old, as ratoons, when cut.

Approximately one half of the plot of B. 208 was dynamited on May 30, 1918. One-third cartridges of Dupont's Red Cross dynamite were placed in two rows along the bed, 8 feet apart, and exploded in holes about 18 inches deep. The dynamited portion gave a yield of 26.91 tons of cane per acre as against 32.06 tons from the non-dynamited half. Practically identical results were obtained in both cases from the analysis of the juice.

TABLE III.

Plant canes and First Ratoons Field 5 and Experiment plots.

ST. AUGUSTINE ESTATE.

CANE.			SUCROSE IN JUICE. TONS PER ACRE.		
			Plants.	1st Ratoons.	Average for 2 years.
D. 504	...	...	3.77	5.18	4.47
B. 208	...	...	4.28	3.62	3.95
Badilla	...	...	3.84	3.70	3.77
D. 2468	...	...	3.55	3.71	3.63
B. 1753	...	...	3.81	3.23	3.52
B. 376	...	...	4.07	2.83	3.45
T. 75	...	...	4.40	2.45	3.42
D. 145	...	...	3.60	2.59	3.09
D. 4397	...	...	3.26	2.92	3.09
B. 147	...	...	2.69	3.31	3.00
B. 3956	...	...	2.90	2.63	2.76
D. 366	...	...	2.88	3.02	2.70
Bourbon	...	...	2.53	2.82	2.67
D. 4805	...	...	1.80	1.77	1.78

It will be seen from the above table that all the varieties with the exception of D. 4805 have given a better return than the Bourbon and that the yield obtained from D. 504 is exceptionally high for ratoons.

B.—RIVER ESTATE.

The canes grown in the River estate Nursery chiefly comprised some new Barbados seedlings which were purchased from the Agricultural Department of that Colony in April, 1913.

At first the canes made little growth owing to the dryness of the weather but with the advent of the rains, in June and July, the plants progressed satisfactorily.

The canes were sampled and analysed on May 6 and 7, 1914 when they were about 12½ months old. The results obtained are recorded in Table IV.

TABLE IV.

Results of analysis of Canes grown in the Nursery at River Estate.—Plant canes about 12½ months old.

CANES.	JUICE						
	Per cent. Extracted.	Brix.	Percentage of			Quotient of purity.	Lb. Sucrose per gallon.
			Sucrose.	Glucose.	Non- sugar.		
B. 6308 ...	64.1	19.8	17.66	0.64	1.50	89.2	1.911
B. 6835 ...	68.4	19.5	17.35	0.60	1.55	89.0	1.875
B. 6388 ...	65.9	19.1	17.04	0.90	1.16	89.2	1.839
B. 6450 ...	68.7	18.7	16.58	0.98	1.14	88.6	1.786
B. 4578 ...	71.6	18.8	15.51	1.73	1.56	82.5	1.672
B. 3390 ...	67.0	18.4	15.44	1.41	1.55	83.9	1.661
B. 1753 ...	67.2	18.2	15.07	1.67	1.46	82.8	1.620
B. 16536 ...	66.3	17.8	14.85	1.50	1.45	83.4	1.594
B. 7169 ...	67.7	18.2	14.53	1.96	1.71	79.8	1.562
B. 4934 ...	64.2	16.8	14.42	1.07	1.31	85.8	1.542
B. 16832 ...	68.1	16.9	13.20	2.14	1.56	78.1	1.412

THE WORLD'S SUGAR CONSUMPTION.

BELOW will be found (taken from the *Indian Trade Journal* of June 18, 1914) the figures showing the consumption per head in the sugar countries of Europe and America during the last two sugar years, 1911-12 and 1912-13. Those relating to Europe are derived from the statistics issued by Otto Licht:—

COUNTRY.	POPULATION 1912-13.	CONSUMPTION SUGAR IN Lb. PER HEAD.	
		1912-13.	1911-12.
Europe--			
Denmark ...	2,760,000	98·96	98·30
United Kingdom ...	46,120,000	95·52	85·54
Switzerland ...	3,820,000	77·24	70·68
Sweden ...	5,600,000	57·09	54·22
Holland ...	6,020,000	49·90	46·42
Germany ...	67,260,000	48·95	41·35
Norway ...	2,420,000	45·83	41·96
France ...	39,600,000	43·41	39·41
Belgium ...	7,520,000	39·20	33·10
Finland ...	3,110,000	32·54	32·49
Austria-Hungary ...	52,040,000	28·12	24·82
Russia ...	133,930,000	24·33	22·81
Turkey ...	23,030,000	19·84	18·62
Spain ...	19,670,000	16·24	13·16
Portugal ...	5,800,000	13·57	13·47
Greece ...	2,790,000	11·51	8·79
Italy ...	34,700,000	10·76	10·47
Servia ...	2,970,000	9·31	10·89
Rumania ...	72,50,000	9·20	11·11
Bulgaria ...	4,360,000	8·38	10·27
Average for Europe ...	470,770,000	36·59	32·93
United States (W. & G.) ...	98,181,000	85·40	81·80
Australia ...	...	...	109·37

C A C A O.

AN ALGAL DISEASE OF CACAO.

Cephaleuros virescens.

At the July meeting of the Board of Agriculture Mr. J. B. Rorer, Mycologist drew attention to a disease of cacao due to an alga, *i.e.*, a member of the class of plants most familiar as the green filamentous or thread-like masses commonly occurring in pools, streams, etc. Some however live on the leaves and stems of other plants particularly in the tropics, without however as a rule doing much if any damage. The one referred to appears to demand more serious attention than most members of its class.

Mr. Rorer said:—"Three years ago my attention was called by Mr. Robert de Verteuil of Felicity Estate, to what appeared to be a new disease of cacao. From what I could learn this disease has been present in Trinidad for a long time but has only attracted much attention within the past three years.

"Mr. Brunton again called my attention to the same disease a few months ago, and told me that it was quite prevalent in some places. This year the disease seems to be widespread throughout the island, but was especially noticeable in the St. Ann's Valley, Diego Martin, in the southern district, and all along the railway line from Caroni to Carapichaima, and also along the Tabaquite line. The disease is manifest by the dying back of shoots, but it has a peculiar characteristic that the leaves turn brown but do not fall, so that a tree badly attacked is covered with dead twigs and brown leaves. At first sight one may think that the trouble results from the girdling of a cacao beetle or an attack of thread blight, but a more careful examination shows that this is not the case. I am not yet in a position to say definitely what the cause of the trouble is, but I suspect it to be due to the attack of a parasitic alga, *Cephaleuros virescens*, which is known to cause a serious disease of tea in India. This alga has always been found associated with the cacao disease here and is very probably the cause. The alga is very widespread throughout the tropics, and it seems just now to be adapting itself to a parasitic mode of life on various trees. It has been reported as doing considerable damage to mangoes in India, and I have observed it quite commonly on mango trees here in Trinidad. I hope to make a more detailed report in regard to this later."

The following is Mr. Brunton's report on this pest taken from his diary for April 1914:

"At the request of the manager of ———— estate, a visit was paid there principally to see the citrus cultivation and grafted and budded fruits. There are two fields of budded oranges coming on nicely and a small field of grafted mangoes with a few budded avocado pears, all doing fairly well. The cacao over the river is very bad and is in fact dying out. It would be better not to attempt the cultivation of cacao there but to plant oranges or limes. All the young trees are attacked by a disease (a species of alga) which stunts their growth, kills off the branches and precludes all possibility of their proper development. As this seems a disease peculiar to poor soils and unshaded cacao, thick shading and intensive cultivation, particularly heavy dressing of pen manure, were recommended if the attempt to raise cacao was persisted in."

Mr. Brunton in his diary for June reports another case:

"The algal disease, known in Europe as red blight, and mentioned in my diary of April 1914, has been noted here; contrary to previous experience, the soil, though sandy, is not poor, and the attacked trees are well grown and of a fair size not mere supplies as at— ———— and other places where the soil is impoverished. The other conditions however are the same namely exposure to sun and wind, it would seem therefore that these latter conditions are favourable to the development of this disease, and also that even in good soil, a large percentage of sand favours its growth. Specimens of this disease were taken to Mr. Rorer, the Mycologist, who recognises it as a red blight known in Europe to attack fruit trees, sometimes doing considerable damage, when spraying with Bordeaux mixture has to be resorted to. Where the attack however is slight it should be controlled by cutting away affected parts and destroying them and by general cultural methods particularly heavy shading."

Mr. Rorer notes that this alga attacks tea plants and mango trees in India. It is also recorded as a pest of cacao in tropical Africa. In the *Bulletin Agricole du Congo Belge*, V, 1914, p. 200, M. Vermoesen the Mycologist describes its occurrence on cacao in that Colony, where it is known as *rouille rouge*, i.e. red rust, red mildew or red blight. It develops generally on the upper side of small twigs, coating them with a light orange-red down which can be seen by the naked eye by turning the twigs towards the light and looking at the surface. The alga produces characteristic black spots on the twigs and causes the leaves to drop prematurely, so that a badly attacked leafy terminal branch will bear only two or three leaves at the end instead of fifteen or twenty. In Trinidad, as recorded above, the leaves do not actually drop but die and turn brown and remain on the tree. In the Belgian Congo the disease is most prevalent on parts exposed to the sun, and where attempts have been made to cultivate cacao without shade. These are also the conditions under which Mr. Brunton has found the disease in this Colony and in his remedial methods noted above he advocates heavy shading. It would appear therefore that this alga may prove another factor which will have to be taken into account in helping to decide for any locality the old question of Shade or No Shade.

W. G. F.

BUDDING OF CACAO.

THE budding of cacao has been continued at St. Clair Experiment Station with satisfactory results, and about 150 plants have been placed out in the experiment plot area at St. Augustine alongside the beds of grafted plants.

The larger experiment at River Estate will be proceeded with towards the end of the year when seeds are available for the control plots of seedlings from the same trees.

Meanwhile 100 plants are being budded each month at St. Clair in order to ascertain whether the season has any appreciable result on the percentage of successes attained. The Department has now available about 200 plants, budded from selected trees at River Estate.

In order to give any planter an opportunity of trying for himself a few budded plants these are offered for sale, in lots of not more than six to any one applicant, at sixpence each. Application should be made to the Curator, St. Clair Experiment Station. Larger supplies will it is expected be available shortly.

The following extract is taken from the *Journal of the Jamaica Agricultural Society* XVIII., June 1914, p. 250. Reference to the budding of cacao in Jamaica was made in this *Bulletin* XIII., December 1913, 217 but no information of recent date was then available, it appears that the work has not been continued on any large scale.

"The *Agricultural News*, (Barbados) says: 'During a recent visit to the Government Experiment Station at Trinidad the attention of the writer was directed to several cacao plants in bamboo pots which had been successfully budded.'

"He goes on to speak of the possibility of securing uniformity in the product by this process, not only uniformity in quality but uniformity in bearing. The buds can be taken from the most prolific trees, and as is known to all cacao growers, seedling trees vary enormously in their powers of bearing.

"At one time budding on cacao was carried out at Hope Gardens Jamaica using the patch-budding process: that is a square patch containing the bud was cut out, and a patch of corresponding size cut from the bark of the stock, and the former inserted in its place. Most every one here understands the process of budding orange trees, using the bud with a small shield shape piece of bark and inserting it in a T shape slit cut in the bark of the stock.

"The ordinary method of budding which has been so long in use on citrus trees is now also proved to be successful on cacao; this is known as the T or inverted T process.

"A few planters tried this method of patch-budding of transforming their Calabacillo cacao trees some ten or more years ago, and we saw some good results once at one place. But interest in this budding of cacao trees was not kept up. It seems desirable however, that some experiments should be carried out again."

DYNAMITE ON CACAO ESTATES.

Mr. Joseph de Verteuil, Superintendent of Field Experiments presented the following report to the July Meeting of the Board of Agriculture.

I was in the Tamana district on June 4, 5, 8 and 9 in connection with the dynamiting of the cacao fields, on the *Santa Marta* Estate, which has been under manurial treatment for the last three years.

Half cartridges (a quarter pound each) were placed between every two cacao trees, so that the charges were about 12 feet apart. The effect on the soil was good, very few "blow outs" having been experienced, especially after the first day, when the labourers had got into the correct way of tamping.

The limestone formation was occasionally met at a depth of 2 feet 6 inches to 3 feet. It was also observed that holes drilled a couple of days in advance collected water and there is reason to believe that in the rainy season water stagnates 2 to 3 feet below the surface of the soil and cannot be removed by ordinary drainage. In this respect the use of dynamite should prove valuable.

The total cost of the experiment is \$206.88 for $5\frac{1}{2}$ acres or \$37.60 (£7 16 8) per acre.

At this stage it is interesting to note the results obtained from the plots on this estate.

Average of manured plots for 1911-1912	...=	8.18	Pods per tree.
" control " " "	...=	5.76	" " "
" manured plots for 1912-1913	...=	9.82	" " "
" control " " "	...=	6.21	" " "
Increase from manured plots compared with crop 1911-1912	...	...=	1.64 Pods per tree.
Increase from control plots compared with crop 1911-1912	...	...=	0.45 " " "
Probable increase due to manuring	...=	1.19	" " "
Average of manured plots for 1913-1914	...=	23.44	Pods per tree.
" control " " "	...=	15.99	" " "
Increase from manured plots compared with crop 1911-1912	...	...=	15.26 " " "
Increase from control plots compared with crop 1911-1912	...	...=	10.28 " " "
Probable increase due to manuring	...=	5.03	" " "

By comparing the yield of the control plots from the above figures the beneficial effects of a favourable season (as that of the past year) is quite apparent, but it will be seen also that the manured plots have given a larger increase than the control plots.

COCONUTS.

MANURIAL EXPERIMENTS ON COCONUTS 1913-14.

By JOSEPH DE VERTEUIL, F.C.S.,
Superintendent of Field Experiments.

THIS report deals with the third year's results of the manurial experiments on coconuts, under the control of the Board of Agriculture and is in continuation of the reports for 1911-12 * and 1912-13. †

Another very dry year was experienced. On the Morvant estate, at Laventille, the rainfall for the period under review has been the smallest of the past three dry years and the crop has suffered in consequence. The percentage of "selects," ‡ however, has not been materially affected.

On the Beaulieu estate, at Cedros, there has been a general improvement on the previous year. But although the average number of nuts picked per tree is practically the same as in 1911-12 the percentage of "selects" is still much lower.

The results obtained on the King's Bay estate, in Tobago, are with few exceptions, lower than for the two previous years.

It has been pointed out in previous reports that the yield for 1911-12 may be considered as a "natural yield" for each plot, owing to the fact that the manures had only been applied shortly before. This year's yield may therefore be compared with that obtained from the corresponding plots for 1911-12, but it is not advisable to draw conclusions from the results of a single year.

The figures obtained are given in Tables I to VI for each estate respectively. In these tables the heading "value of probable increase or decrease due to manuring" may require some explanation. The probable increase or decrease due to manuring is the increase or decrease of the manured plots to which is added or deducted the decrease or increase shown by the average of the control plots. When the control plots show an increase it is probable that the manured plots show a larger increase than what is actually due to manuring and the natural increase indicated by the control plots must be deducted to arrive at correct results. The writer is perfectly aware that all the plots will not, under uniform conditions, show the same increase or decrease each year, but if the average be taken over a series of years the error will be greatly reduced.

"Decrease due to manuring" means that the cost of the manures and of their application is greater than the value of the increased yield obtained.

Throughout this report control plots mean the *average* for the control plots.

In calculating the yield and cost of manuring per acre, it has been assumed that there are 75 trees to the acre, as the trees are planted 24 feet apart. The price of "selects" has been fixed at \$25.00 and that of "culls" at \$15.00 per 1,000.

The net pecuniary results of the experiments, for the year under review, are indicated graphically in the diagram appended to the report.

* *Bulletin, Department of Agriculture.* Vol. XI. 1912, pp. 179-184.

† *Bulletin, Department of Agriculture.* Vol. XIII. 1914 pp. 1-7.

‡ "Selects" or "Standard" nuts are those which when husked do not pass through a ring $3\frac{1}{4}$ inches in diameter and are otherwise sound. "Culls" are sound nuts measuring between 3 and $3\frac{1}{4}$ inches in diameter.

MORVANT ESTATE—LAVENTILLE.

The third application of manures was made in July 1913. Before spreading the manures the soil around the trees was lightly forked.

Rainfall, July 1, to June 30... .. { 1911-12 = 39.12 in.
1912-13 = 41.27 in.
1913-14 = 37.74 in.

TABLE I.—MANURIAL EXPERIMENTS, MORVANT ESTATE.

Trees about 27 years old.

lot.	No. of bearing trees.	Manures applied per tree.	Crop July 1, to June 30.	Average number of nuts picked per tree.	Per cent. Selects.	PER ACRE.					
						Selects.	Culls.	Value of increase or decrease on crop 1911-12.	Value of probable increase or decrease due to manuring.	Cost of manuring 1912-13.	Gain or loss on average of no manure plots.
1	68	{ 4 lb. Lime ... 4 ,, Kainit ... }	1911-12	20.3	58.9	899	627	% c.	% c.	% c.	% c.
			1913-14	22.1	60.8	1,009	651	+ 3 11	+ 2 33	4 07	- 1 74
2	69	{ 6 lb. Basic slag 1 ,, Sulphate of potash }	1911-12	38.9	63.7	1,857	1,059				
			1913-14	25.3	64.0	1,215	683	- 21 69	- 22 47	6 21	- 28 68
3	70	Control — No manure	1911-12	40.7	58.5						
			1913-14	40.4	45.4						
4	67	{ 4 lb. Basic slag 2 ,, Nitrate of soda }	1911-12	35.1	65.2	1,719	917				
			1913-14	28.3	62.1	1,316	804	- 11 77	- 12 55	7 26	- 19 81
5	69	{ 2 lb. Calcium cyanamide 2 ,, Sulphate of potash }	1911-12	43.8	61.1	2,006	1,278				
			1913-14	34.4	64.2	1,655	923	- 14 10	- 14 88	8 34	- 23 22
6	69	Control — No manure	1911-12	25.9	64.9						
			1913-14	29.4	64.9						
7	69	{ 2 lb. Bone meal 1 ,, Sulph. of ammonia 150 ,, Pen manure }	1911-12	41.0	60.8	1,872	1,207				
			1913-14	28.2	66.8	1,411	702	- 19 10	- 19 88	13 66	- 33 54
8	67	{ 2 lb Superphos. of lime 1 ,, Sulphate of potash 150 ,, Pen manure }	1911-12	31.1	61.9	1,443	889				
			1913-14	22.7	66.2	1,126	575	- 12 63	- 13 41	12 71	- 26 12
		Average—Control plots ...	1911-12	33.3	61.0	1,525	975				
			1913-14	35.0	54.1	1,419	1,204	+ 0 78			

* From the above table it will be seen that plot 1 and the control plots alone have given an increased yield compared with crop 1911-12, but the increase from plot 1 is 1.8 nut per tree against 1.7 for the control plots.

The percentage of selects has increased for each plot respectively compared with crop 1911-12, except for plot 4 and the control plots which show a decrease of 8.1 and 6.9 per cent. respectively.

When, however, the probable increase for each plot is calculated and the cost of manuring deducted as shown in the diagram page 274, none of the plots show a gain, owing to the large decrease in the yield of the manured plots.

BEAULIEU ESTATE—CEDROS.

These experiments are being conducted in three series A, B and C as shown in tables II to IV. The average results obtained for the three series are given in table V.

The manures were applied in March, 1913, but the land was not forked.

Rainfall, July 1, to June 30 { 1911-12 = 39.84 in.
1912-13 ... 55.76 in.
1913-14 ... 49.60 in.

TABLE II.—MANURIAL EXPERIMENTS.—BEAULIEU ESTATE, CEDROS.—SERIES A.

Trees 32 to 37 years old.

Plot.	No. of bearing trees.	Manures applied per tree.	Crop July 1. to June 30.	Average number of nuts picked per tree.	Per cent. Selects.	PER ACRE.						Gain or loss on average of no manure plots.
						Selects.	Culls.	Value of increase or decrease on crop 1911-12.	Value of probable increase or decrease due to manuring.	Cost of manuring 1912-13.		
								% c.	% c.	% c.	\$ c.	\$ c.
1	15	4 lb. Lime ...	1911-12	135.9	40.2	4,096	6,094					
		4 „ Kainit ...	1913-14	77.1	49.0	2,835	2,950	-78	68	-24	62	5 60 -30 22
2	17	6 lb. Basic slag	1911-12	107.4	58.3	4,695	3,358					
		1 „ Sulphate of potash	1913-14	63.1	53.1	2,514	2,220	71	50	-17	53	7 85 -25 38
3	12	Control — No manure.	1911-12	120.8	46.3	...	...	...	...	...	...	...
			1913-14	91.0	36.6	...	...	...	...	...	...	...
4	14	5 lb. Basic slag	1911-12	135.1	58.2	5,896	4,234					
		2 „ Nitrate of soda	1913-14	102.1	36.9	2,825	4,830	-67	83	-13	77	7 50 -21 36
5	15	2 lb. Calcium cyanamide	1911-12	138.9	45.6	4,751	5,609					
		2 „ Sulphate of potash	1913-14	107.5	37.9	3,057	5,008	-52	26	+ 1	80	9 56 - 7 76
6	14	Control — No manure.	1911-12	146.8	65.6	...	...	...	...	...	...	...
			1913-14	81.8	31.6	...	...	...	...	...	...	...
7	15	2 lb. Bone meal	1911-12	126.4	54.8	5,195	4,285					
		1 „ Sulp. of ammonia 150 „ Pen manure	1913-14	88.4	40.0	2,652	3,978	-68	18	-14	12	13 39 -27 51
8	15	2 lb. Superphosp. of lime	1911-12	125.5	59.4	5,584	3,816					
		1 „ Sulphate of potash 150 „ Pen manure	1913-14	106.8	48.5	3,885	4,125	-37	84	+ 16	22	11 92 + 4 30
		Average—Control plots ...	1911-12	134.3	57.2	5,761	4,311	...	...	...	...	...
			1913-14	106.0	44.5	3,538	4,412	-54	06	..	...	...

TABLE III.—MANURIAL EXPERIMENTS, BEAULIEU ESTATE, CEDROS.—SERIES B.

Trees 32 to 37 years old.

Plot.	No. of bearing trees.	Manures applied per tree.	Crop July 1, to June 30.	Average number of nuts picked per tree.	Per cent. Selects.	PER ACRE.					
						Selects	Culls.	Value of increase or decrease on crop 1911-1912.	Value of probable increase or decrease due to manuring.	Cost of manuring 1912-13.	Gain or loss on average of no manure plots.
								\$ c.	\$ c.	\$ c.	\$ c.
1	19	4 lb. Lime	1911-12	83.0	60.9	3,791	2,434				
		4 „, Kainit	1913-14	86.4	52.0	3,370	3,111	- 0 37	- 6 17	5 60	- 11 77
2	20	6 lb. Basic slag	1911-12	70.0	78.1	4,100	1,150				
		1 „, Sulphate of potash	1913-14	70.4	56.6	2,988	2,291	- 10 68	- 16 48	7 65	24 33
3	29	Control — No manure	1911-12	50.1	70.9						
			1913-14	65.3	40.2						
4	25	4 lb. Basic slag	1911-12	54.9	67.7	2,788	1,331				
		2 „, Nitrate of soda	1913-14	90.5	46.0	3,121	3,665	+ 43 33	+ 37 53	7 59	+ 29 94
5	25	2 lb. Calciumcyanamide	1911-12	61.7	65.3	3,024	1,607				
		2 „, Sulphate of potash	1913-14	90.2	39.5	2,672	4,093	- 28 49	+ 22 69	9 56	+ 13 13
6	22	Control — No manure	1911-12	65.3	51.1						
			1913-14	71.8	36.1						
7	24	2 lb. Bone meal	1911-12	56.1	54.4	2,291	1,920				
		1 „, Sulp. of ammonia 150 „, Pen manure	1913-14	76.2	24.3	1,388	4,324	- 13 48	+ 7 68	13 39	- 5 71
8	26	2 lb. Superphos. of lime	1911-12	57.3	59.3	2,549	1,749				
		1 „, Sulp. of potash 150 „, Pen manure	1913-14	90.3	20.1	1,361	5,412	+ 25 24	+ 19 44	11 92	+ 7 52
		Average—Control plots	1911-12	57.4	60.1	2,586	1,717				
			1913-14	68.1	38.3	1,957	3,152	+ 5 80			

TABLE IV.—MANURIAL EXPERIMENTS.—BEAULIEU ESTATE, CEDROS.—SERIES C.

Trees 32 to 37 years old.

Plot.	No. of bearing trees.	Manures applied per tree.	Crop July 1, to June 30.	Average number of nuts picked per tree.	Per cent. Selects.	PER ACRE.					
						Selects.	Culls.	Value of increase or decrease on crop 1911-12	Value of probable increase or decrease due to manuring.	Cost of manuring. 1912-13.	Gain or loss on average of no manure plots.
								% c.	% c.	% c.	% c.
1	26	4 lb. Lime ...	1911-12	55.8	55.9	2,339	1,846				
		4 „, Kainit ...	1913-14	82.9	23.0	1,430	4,789	+21 42	+11 83	5 60	+ 6 23
2	24	6 lb. Basic slag	1911-12	82.4	50.9	3,704	2,480				
		1 „, Sulphate of potash	1913-14	84.1	34.3	2,163	4,143	-13 58	-23 17	7 85	-31 02
3	25	Control — No manure	1911-12	59.0	57.1						
			1913-14	76.6	28.8						
4	24	4 lb. Basic slag	1911-12	63.9	49.8	2,387	2,408				
		2 „, Nitrate of soda	1913-14	68.2	27.7	1,417	3,699	- 4 93	14 52	7 59	-22 11
5	16	2 lb. Calcium cyanamide	1911-12	103.3	57.7	4,472	3,279				
		2 „, Sulphate of potash	1913-14	103.4	32.3	2,504	5,249	-19 65	-29 24	9 56	-38 80
6	18	Control — No manure	1911-12	77.6	54.1						
			1913-14	91.5	37.6						
7	18	2 lb. Bone meal	1911-12	101.9	49.4	3,777	3,869				
		1 „, Sulp. of amuronia	1913-14	106.5	25.9	2,070	5,922	-11 88	-21 47	13 39	-34 86
		150 „, Pen manure									
8	19	2 lb. Superph. of lime	1911-12	98.7	50.9	3,768	3,634				
		1 „, Sulphate of potash	1913-14	87.6	47.4	3,115	3,457	-18 98	-28 57	11 92	-40 49
		150 „, Pen manure									
		Average — Control plots	1911-12	67.5	55.5	2,809	2,252				
			1913-14	82.8	32.9	2,043	4,168	+ 9 59			

TABLE V.—MANURIAL EXPERIMENTS.—BEAULIEU ESTATE, CEDROS.

Average of Series A, B and C.

Plot.	Crop July 1, to June 30.	Average number of nuts picked per tree.	Per cent. Selects.	PER ACRE.					
				Selects.	Culls.	Value of increase or decrease on crop 1911-12.	Value of probable increase or decrease due to manuring.	Cost of manuring 1912-13.	Gain or loss on average of no manure plots.
1	1911-12	84.4	51.3	3,248	3,083	% c.	% c.	% c.	% c.
	1913-14	82.6	38.7	2,397	3,797	-10 56	-3 40	5 60	-9 00
2	1911-12	84.2	64.9	4,100	2,218				
	1913-14	73.4	46.7	2,572	2,936	-27 43	-20 27	7 85	-28 12
3	1911-12	68.4	57.1						
	1913-14	74.2	35.0						
4	1911-12	75.7	58.6	3,327	2,351				
	1913-14	84.6	37.9	2,404	3,939	+0 74	+7 90	7 59	+0 31
5	1911-12	94.2	55.4	3,916	3,153				
	1913-14	98.6	36.9	2,729	4,666	-6 98	+0 18	9 56	9 38
6	1911-12	89.6	57.9						
	1913-14	90.5	41.2						
7	1911-12	88.0	52.8	3,484	3,115				
	1913-14	89.0	29.0	1,935	4,739	-14 36	-7 20	13 39	-20 59
8	1911-12	86.2	56.3	3,639	2,825				
	1913-14	93.6	36.3	2,548	4,471	-2 58	+4 58	11 92	-7 34
Average—Control plots.	1911-12	78.6	57.5	3,388	2,504				
	1913-14	81.6	38.1	2,331	3,788	-7 16			

The figures in Table V show that plots 4, 5, 7, 8 and the control plots have given an increased yield compared with crop 1911-12, but the increased yield from plot 7 is less than that of the control plots.

There has been a general decrease in the percentage of selects from all the plots compared with 1911-12 but the decrease is less in plots 1, 2 and 5 than for the control plots.

When the probable increase for each plot is calculated and the cost of manuring deducted, as shown in the diagram page 274, plot 4 alone shows a gain of \$0.81.

KING'S BAY ESTATE, TOBAGO.

The third application of manures was made in May, 1913, and the soil lightly forked.

Rainfall, July 1 to June 30... { 1911-12 = 66.71 in.
1912-13 = 64.57 in.
1913-14 = 64.45 in.

TABLE VI.—MANURIAL EXPERIMENTS.—KING'S BAY ESTATE.

Trees 22 to 27 years old.

Plot.	No. of bearing trees.	Manures applied per tree.	Crop July 1, to June 30.	Average number of nuts picked per tree.	Per cent. Selects.	PER ACRE.					
						Selects.	Culls.	Value of increase or decrease on crop 1911-12.	Value of probable increase or decrease due to manuring.	Cost of manuring 1912-13.	Gain or loss on average of no manure plots.
								%	c.	%	c.
1	52	4 lb. Lime ...	1911-12	74.4	70.1	3,914	1,639				
		4 „ Kainit...	1913-14	49.4	66.1	2,447	1,255	-42.88	-39.98	3.79	-43.77
2	69	6 lb. Basic slag	1911-12	56.2	67.2	2,831	1,382				
		1 „ Sulphate of potash	1913-14	48.6	71.0	2,590	1,058	-10.88	-7.98	5.91	-13.89
3	57	Control — No manure	1911-12	60.3	68.0						
			1913-14	59.3	67.8						
4	77	4 lb. Basic slag	1911-12	51.1	69.1	2,649	1,185				
		2 „ Nitrate of soda	1913-14	55.0	57.8	2,384	1,741	+1.71	+4.61	6.63	-2.02
5	70	2 lb. Calcium cyanamide	1911-12	67.6	67.0	3,395	1,673				
		2 „ Sulphate of potash	1913-14	84.9	57.4	3,657	2,715	+22.18	+25.08	8.41	+16.67
6	79	Control — No manure	1911-12	58.4	68.2						
			1913-14	59.9	54.4						
7	67	2 lb. Bone meal	1911-12	54.1	68.7	2,789	1,271				
		1 „ Sulphate of ammonia	1913-14	68.8	60.6	3,098	2,065	+19.63	+23.53	5.13	+17.40
8	76	2 lb. Superphos. of lime	1911-12	60.4	67.1	3,042	1,492				
		1 „ Sulphate of potash	1913-14	89.0	59.4	3,964	2,710	+41.32	+41.22	3.84	+40.38
		Average—Control plots	1911-12	59.2	68.2	3,027	1,412				
			1913-14	59.6	60.0	2,684	1,790	-2.90			

It will be seen from Table VI that the yield of plots 4, 5, 7, 8 and the control plots has increased as compared with that of 1911-12, but that the increase from these manured plots is greater than that of the control plots.

For the period under review, plot 2 alone has given a larger percentage of selects than for 1911-12, but the decrease in the percentage of selects is less for plots 1 and 8 than for the control plots.

When the value of the probable increase for each plot is calculated and the cost of manuring deducted, as shown in the diagram page 274, plots 5, 7 and 8 show a gain of \$16.67, \$17.40 and \$40.88 per acre respectively.

EXPLANATION OF DIAGRAM.

The plots are indicated by the numbers 1, 2, 4, &c.

Each distance from 0 to 10, 10 to 20, &c., represents ten (10) dollars and therefore the space from any one horizontal line to the next is equivalent to one (1) dollar.

The returns of the control plots in each series, indicated by the dotted red lines at 0, has been taken as the base line, and the result for each of the other plots calculated in the following manner. From the increase or decrease in value of the nuts on a manured plot over the same plot in the first year of the experiment has been added or deducted the decrease or increase in the yield on the control plots during the same period, and the result is taken as indicating the difference in the manured plots due to manuring. For example, plot 4 in Table VI, King's Bay estate, shows an increase over crop 1911-12, valued at \$1.71, and the control plots a decrease of \$2.90, the value of the probable increase due to manuring is therefore $\$1.71 + \$2.90 = \$4.61$.

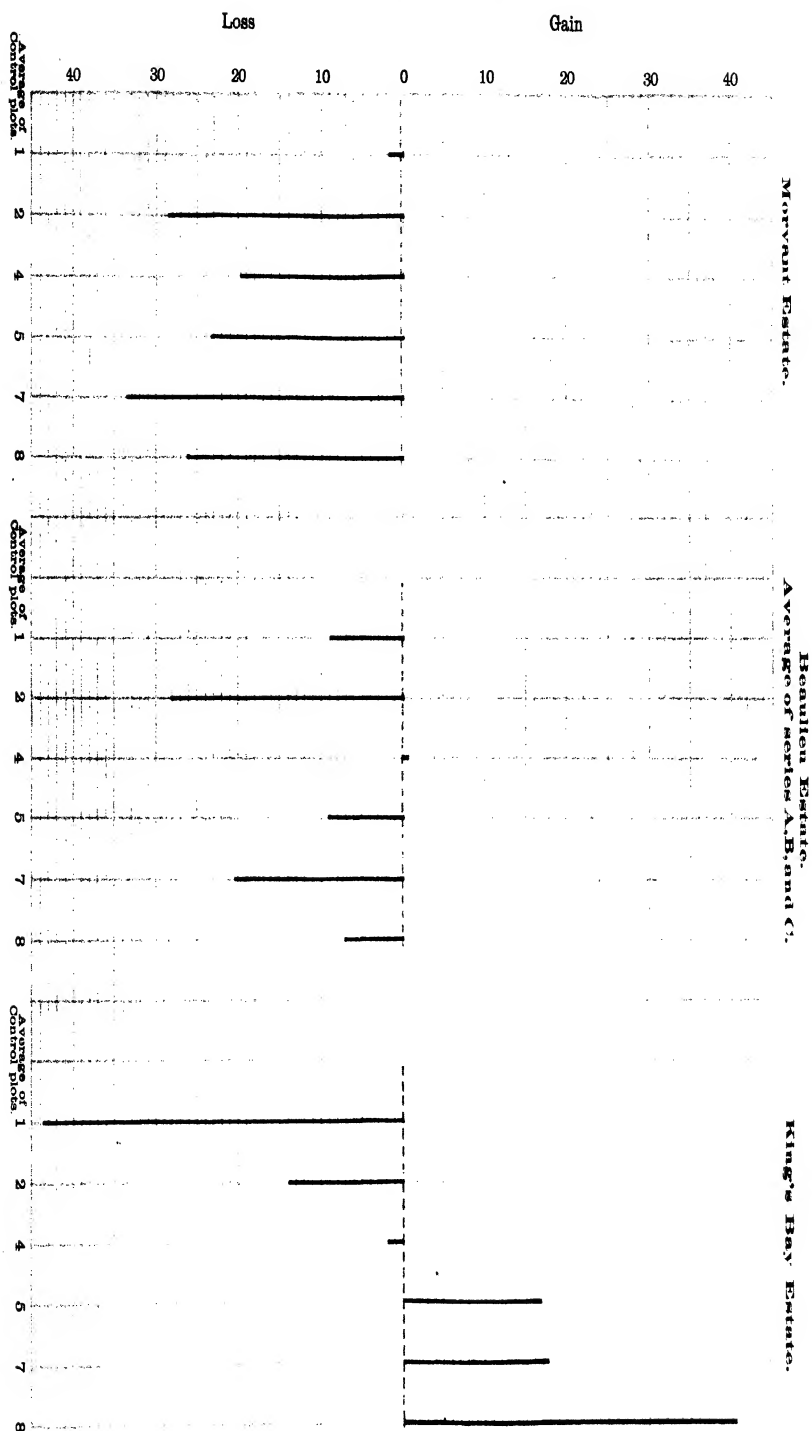
From this is deducted the cost of manuring; the result indicates the gain or loss on manuring. Thus \$4.61 less \$6.63 = a loss of \$2.02.

This value is plotted to scale, above the base line when the result on manuring has been a gain and below it when a loss.

The diagram thus indicates the general monetary results for each plot in each experiment and renders it easily possible to compare results throughout the set of experiments. For the detailed figures, and such important points as the relative proportion of "selects" and "culls" the tables themselves should be consulted.

Gain or loss on manuring for each plot respectively for 1913-14.

DIAGRAM SHOWING NET PECUNIARY RESULTS.



NATURAL YIELD OF PLOTS.

As in the case of the cacao experiments * it has been found necessary to ascertain the *natural yield* of coconut trees previous to applying manures so that correct conclusions may be arrived at. Fourteen plots have accordingly been marked out on two estates with the object of ascertaining the *natural yield* for each plot over a series of years, before the application of any manures. With coconuts, not only is it necessary to keep account of the number of nuts picked but it is equally important to note the percentage of selects, as it forms an important factor in calculating the value of the produce reaped.

The two estates on which these *natural yields* are being kept are Plaisance, at Claxton Bay and Ste. Marie, in Tobago.

The trees on the Plaisance estate are about 20 years old and the soil may be described as a loam varying to a clay loam situated on the Claxton's Bay beach. On the Ste. Marie estate, the soil for plots 1 to 7 is a clay loam situated on a plateau about 100 feet above sea level, whereas the soil on which plots 8 to 14 are situated, is sandy and on the Mount Irvine beach, barely a quarter of a mile from plots 1 to 7. The age of the trees on plots 1 to 7 is 22 years and the trees on plots 8 to 14 are about 50 years old.

The results obtained from these plots for the twelve months from January 1 to December 31, 1913 are recorded in Table VII.

* *Bulletin, Department of Agriculture*. Vol. XII. 1913, page 214.

TABLE VII.—NATURAL YIELD OF PLOTS.

Plot.	PLAISANCE ESTATE, CLAXTON'S BAY.					STE. MARIE ESTATE, TOBAGO.				
	Average number of nuts picked per tree.	Per cent. Selects.	Per acre.			Average number of nuts picked per tree.	Per cent. Selects.	Per acre.		
			Selects.	Culls.	Value of Crop.			Selects.	Culls.	Value of Crop.
1	27.5	40.5	837	1,229	\$ 39 36	41.3	36.1	1,116	1,976	\$ 57 54
2	22.8	43.5	742	965	32 02	29.4	38.8	856	1,351	41 66
3	23.5	40.4	711	1,050	33 52	28.5	44.9	959	1,178	41 64
4	20.9	42.0	659	910	30 12	10.7	15.0	120	680	13 20
5	24.0	39.8	716	1,084	34 16	17.0	20.9	266	1,009	21 78
6	25.7	43.5	839	1,091	37 34	24.2	44.1	801	1,016	35 26
7	21.9	39.1	643	1,003	31 12	30.6	38.0	872	1,423	43 14
8	22.2	43.1	717	947	32 13	62.6	16.1	756	3,938	77 97
9	19.1	44.6	639	794	27 88	73.4	16.6	914	4,591	91 71
10	17.5	45.3	596	720	25 70	70.3	11.3	596	4,675	85 02
11	21.0	46.3	729	846	30 91	70.7	12.7	673	4,630	86 27
12	18.6	53.7	584	504	22 16	93.1	21.3	1,488	5,199	119 68
13	21.8	52.5	860	778	33 17	57.2	18.4	790	3,503	72 29
14	22.3	51.8	865	805	33 70	58.8	20.4	900	3,512	75 18

A comparison of the figures recorded above for Plaisance estate shows that the yield varies from 17.5 to 27.5 nuts per tree for plots 10 and 1 respectively or a difference of 750 nuts per acre. Again the percentage of selects varies from 39.1 to 53.7 for plots 7 and 12 respectively. When, however, these two factors, viz.:—the yield per acre and percentage of selects are taken into consideration the value of the produce is \$22.16 and \$39.36 for plots 12 and 1 respectively i.e. a difference of \$17.20 between the plots giving the lowest and highest results. Similarly there is a difference of \$44.34 and \$47.89 between the highest and lowest figures for plots 1 to 7 and plots 8 to 14 respectively, on the Ste. Marie estate plots.

It is evident from the above that it would be absolutely incorrect to consider any one plot as a control for the remaining plots, but when the natural yield of these plots has been ascertained over a series of years it will be possible to judge of the beneficial results or otherwise of any manures applied to these same plots.

FOODSTUFFS.

THE MANUFACTURE OF CASSAVA FARINE.

Cassava Farine is made from both the bitter and sweet varieties, although the former is the one more generally used.

Great attention should be paid to cleanliness throughout the process of manufacture, as upon this depends the appearance of the finished product, which should be of a pure white colour.

The process of manufacture can be conveniently divided into three parts:

1. Cleaning the roots.
- 2.—(a.) Grating, (b.) Draining, (c.) Sifting.
3. Drying.

CLEANING.

This is done first by scraping, which however, must be done much more thoroughly than for the manufacture of starch, when only the thin brown outer skin is removed; scraping for this purpose must be continued until the yellowish underskin is removed, and the whole root is perfectly white, the scraped roots are then washed in clean water after which they are ready for the next operation.

GRATING, DRAINING, SIFTING.

Grating.—The washed roots are next grated as finely as possible; this is usually done with any ordinary grater, but when large quantities have to be done this method proves too slow and costly, so that mechanical assistance becomes necessary, a primitive but very effective machine for this purpose can very easily be built as follows:—

A wooden wheel is constructed $2\frac{1}{2}$ to 3 feet in diameter, the felloes being 6 to 8 inches broad upon which a copper sheet perforated to form a grater is fastened, only 4 spokes placed at right angles to each other are necessary with an axle passed through the point of intersection, this wheel is mounted on a strong frame, a crank and handle being attached to one or both extremities of the axle, the frame is boxed in below to receive the grated material as it falls from the wheel, a sliding door being provided at one side for the removal of this pulp. The wheel may also be boxed in on top if required.

Draining.—This is effected either by packing the pulp in coarse sacks upon which weights are placed which are added to from time to time, or much more effectively by the use of the "Coulef."

The "Coulef" is a cylindrical narrow close-woven basket, about four feet long and four to six inches wide, open at the upper end with a loop at each end, the cassava pulp is packed tightly into this, it is then hung up by the loop at the upper end, a wooden bar is inserted in the lower loop and weights are attached to this bar which causes the "Coulef" to stretch, increasing its length but decreasing its girth and by the pressure thus evenly distributed throughout its length on the pulp contained within squeezing out the juice at all points which is caught in a vessel placed below to receive it,* as the juice runs out

* A small percentage of starch can be recovered from this juice, but great care must be exercised in disposing of it so as to prevent stock of any kind from drinking it, as it is a deadly poison.

the level of the pulp in the "Coulef" sinks, this is filled up from time to time with fresh pulp, shaking it well down at each filling, until no more can be introduced, when draining is complete, except the top six inches which is separated from the rest (to be returned to the "Coulef") when the pulp is removed to undergo the next process.

Sifting.—The drained pulp is rubbed through a coarse sieve to remove the fibrous portions of the heart or any lumps, &c. that have escaped the grater, it is now ready for the final stage.

DRYING.

Drying is effected over a wooden fire on a circular iron plate called a "platin" which is usually built over a clay fire place.

This is the most critical and laborious part of the whole operation, great care should therefore be exercised to keep a uniform heat and to keep the farine constantly in motion, or drying will be very irregular and an uneven sample, both in texture and colour will be the result.

At first the temperature should be low and stirring should be rapidly and vigorously performed, so as to prevent the pulp from sticking together and forming coarse lumps, as the pulp dries the temperature may be gradually increased, care being taken that it never rises sufficiently high to cause parching; it is difficult if not impossible to describe the signs by which it is known when the farine is thoroughly dry, both the sense of touch and of taste are used, but the surest sign to the practised hand is the peculiar rustling sound which the farine makes as it is stirred over the "platin" when drying is complete.

Thorough drying takes from three to four hours.

L. A. BRUNTON.

USES OF CASSAVA.

CASSAVA for home consumption may be utilised in various ways, viz. :—

- (1.) Boiled plain.
- (2.) Fried and made into fritters.
- (3.) Fried and made into bullets.
- (4.) Fried and made into bullets and served with syrup as a dessert.
- (5.) Starch: The following is a simple but very practical way for the small proprietor to extract his starch.

Grate the cassava root and pass it through a sieve, wash and decant off the liquid until milkiness disappears, the sediment at the bottom of the vessel is the starch. The residue in the sieve after straining is then set aside and utilised for stock food.

(6.) Cassava Bread and Farine: Grate the cassava (the finer the grater the finer the cassava or farine) place the grated material in a Sebucan or long plaited strainer suspended from the upper end and with a cross pole at the lower closed end. Press the pole downwards by weights

so as to squeeze out all the liquid that may be in the pulp (keep this liquid for further use in making "casseripe.")

This pulp which is practically free from liquid is put in a shallow pan over a slow fire and kept stirred with a stick to prevent the particles from binding together; this forms farine.

Cassava Bread.—To make cassava bread, take this pulp and form it into flat cakes and bake over a slow fire on a flat iron, using an iron hoop to shape to the size required.

Casseripe.—The liquid from process No. 5 cannot be used for casseripe, but the liquid from No. 6 (in making cassava bread and farine) can by boiling be evaporated down to a thick syrupy liquid which is casseripe. In Venezuela they boil it down with cow heel which adds nourishing properties.

The casseripe is used in preparing pepper pot, which is a very valuable asset in a household.

H. CARACCILO.

PLANT DISEASES AND PESTS.

PARASOL ANTS.

His Excellency the Governor has proclaimed parasol ants a pest under the Plant Protection Ordinance. As a result an order can now be served on any one having nests of this pest on his land to destroy the same.

TRINIDAD AND TOBAGO.

No. 48 of 1914.

[L.S.]
GEORGE R. LE HUNTE,
Governor.

By His Excellency Sir George Ruthven
Le Hunte, G.C.M.G., Governor and Com-
mander-in-Chief in and over the Colony
of Trinidad and Tobago and its
Dependencies, Vice-Admiral thereof,
&c., &c., &c.

A PROCLAMATION.

Whereas by Section 2 of the Plant Protection Ordinance, 1911 (No. 38 of 1911) it is among other things enacted that the term "*Pest*" means any parasitical epiphytal or other animal or vegetable organism affecting trees, shrubs, or herbs which the Governor may by proclamation from time to time declare to be a pest within the meaning of the Ordinance;

Now, therefore, I, George Ruthven Le Hunte, Governor as aforesaid, do hereby declare the parasol ant to be a pest within the meaning of the said Ordinance.

Given under my hand and the Seal of the
Colony, at Government House, in the
Town of Port-of-Spain, in the Island of
Trinidad, this nineteenth day of
August, 1914.

By His Excellency's Command,

S. W. KNAGGS,
Colonial Secretary.

FROGHOPPERS.

The following Circular has been sent to the Managers of sugar estates by Mr. P. L. Guppy:—

DEPARTMENT OF AGRICULTURE,
October 7, 1914.

Sir,

In regard to froghopper control it is advised that there should be no relaxation of efforts, even small broods of nymphs and adults should be dealt with right up to the end of the year.

At this time of the year the Syrphid will most likely be found in the canefields in many places doing good work. Wherever the maggots are found in the froth,—the field or fields can be left alone—should there be no trace of these however, any nymphs that are seen ought to be destroyed. There is likelihood that fair numbers of the latter will be in evidence during October, and a careful look out for Syrphid maggots should be kept.

Wherever nymphs are too scattered it is not likely that maggots will be found in the froth.

I shall feel much obliged if you will fill in, and return, the accompanying postcard,* with the addition of any remarks you think necessary

Yours faithfully,

(Sgd.) P. L. GUPPY,

Entomologist in charge of Froghopper Investigation.

MYCOLOGICAL NOTES.

SPRAYING EXPERIMENTS.

At the July meeting of the Board of Agriculture Mr. Rorer reported that during June arrangements were made for extending the spraying demonstrations on cacao. In addition to the experiments which have already been started, new plots will be taken up at Toco, Caparo, Siparia and Sangre Grande. The power sprayer which was ordered some time ago has not yet arrived, but is expected soon. Arrangements have been made to try it first on Mr. Maingot's estate at Sangre Grande, as this estate is near the railway, is on level ground and has good roads.

Judging from the appearance of the trees in the districts visited, spraying should be begun within the next few weeks, in fact the trees at Santa Estella Estate, Sangre Grande, have already been sprayed.

A visit was paid to Toco during the first week of July and a second spraying was made on the coconut plots there. So far the experiment has given no results, as no trees have died in either the sprayed or unsprayed plots.

At the September meeting Mr. Rorer stated that since the July meeting of the Board he had made two trips to Tobago, one in July and one in August. On both occasions he visited a number of estates in both the Leeward and Windward districts, and attended a meeting of the Tobago Planter's Association held in Scarborough, on August 31. The coconut plot at Roxborough was again sprayed with Bordeaux mixture. You may remember that this experiment was started for the purpose of testing the value of Bordeaux mixture as a means of controlling bud rot of the coconut palm. So far there have been no striking results; none of the sprayed trees have died from bud rot, but on the other hand, only one of the checked trees has died during the past two years. A similar experiment was started early this year at Toco, and so far, the results are a little better than at Roxborough, for already four trees in the control plots have died from bud rot, while all the sprayed trees are healthy.

The cacao plots at Sangre Grande have already been sprayed, and in the experiment at Toco the first application was made last week. The crop there is looking very well and it is hoped to be able to report favourable results from the spraying when the main pickings begin in December or January.

FROGHOPPERS.

It is quite easy to find dead froghoppers covered with the green muscardine fungus in cane fields which have been diseased. He was sorry to say most of the estates have stopped running their cabinets but several

* Not reprinted (Ed.)

places are still using tubes for hand infection. Now that the frog hopper is apparently at the minimum, it would be well to try and kill as many as possible with the fungus in order to reduce the number of eggs which will carry the insect through the next dry season.

ENTOMOLOGICAL NOTES.

Mr. Urich submitted the following reports to the Board of Agriculture in the months noted at the end of each paragraph.

FROGHOPPERS.

The first signs of froghoppers consisting of adults and nymphs were observed on June 2 at Esperanza Estate. Since then the first brood issued and the second brood is now in the course of oviposition and in some instances in the nymphal state. In connection with the experiments at Esperanza Estate, fields were sprayed with spores of the green muscardine fungus on June 30, and on July 14, dead froghoppers were collected on which the fungus was growing. In some instances fields which had been burnt by accident showed very few nymphs as compared with the unburnt parts. This was no doubt due to the eggs having been deposited in the trash instead of the ground, when deposited in the latter position, they generally escape destruction by fire. In a field at Esperanza Estate where the vermilion egg parasite was established last year, there have been very few nymphs observed when the rains set in. [July.]

Since the last report at the July meeting froghoppers have not been as numerous as in the same months of former years. The green muscardine fungus has been working well and in fields that have been sprayed with spores large numbers of infected insects have been observed. There is no doubt that the various control measures adopted early in the season have produced good results in reducing the pest and it is hoped that they will be continued vigorously. [September.]

SMALL MOTH BORER.

The work of the small moth borer (*Diatraea*) is showing up in the shape of dead hearts; where numerous trap lights should be used for catching the moths and the caterpillars cut out. [July.]

CACAO PESTS.

Cacao beetles and worms are still being caught in some parts of the island, but they are not as numerous as during the dry season. Caterpillars and leaf eating beetles are more in evidence now, but no serious outbreak has been reported. [July.]

Cacao beetles are still in evidence in all stages; in some districts there is more of one stage than the other. Wherever control work is carried out be it hand collecting or spraying there is always a decrease of the insects noticed, but re-infection easily takes place from adjoining places where less or no control work is done. As long as there is no co-operation right through the island, we can never expect to keep down the beetle. No attacks of thrips have been observed or reported [September.]

COCONUT SCALE.

In some localities where the coconut scale (*Aspidiotus destructor*) had obtained good footing on young plants during the dry season, there are numerous little predaceous beetles now at work devouring the scales, which they will no doubt be able to control now. In cases where spraying has to be done for the scale, lime sulphur has given good results in the past. [July.]

The coconut scale (*Aspidiotus destructor*) which as reported at the July meeting was numerous in some localities has been completely wiped out by the predaceous beetle *Cryptognatha nodiceps*, Marshall; the coconut fronds now coming out are free from scales and quite green. When the beetle had almost done its work of destruction of the scales it was noticed that it was attacked by a small hymenopterous parasite that killed many pupæ. [September.]

AGRICULTURAL EDUCATION.

CACAO & VEGETABLE PRIZE COMPETITIONS 1914-15.

The interest in these competitions continues to be well maintained; it is particularly gratifying to find that the suspicions formerly displayed by the peasantry are no longer in evidence except in one district where the oil prospector has been at work with results not always to the advantage of the small proprietor who now has a decided disinclination to put his name to any document, even an entry form for a prize competition.

CACAO COMPETITION.

In the Oropouche and Erin districts the entries in the cacao competition are as follows.—

Class i.—Peasant Proprietors	...	...	...	81
Class ii.—Contractors...	...	...	...	91

In addition eight former prize winners in Class i have entered for the Special Competition, and ten in Class ii. Making a total in the districts over which Mr. Brunton is in charge of 237 competitors.

In the Brasso, Piparo districts the entries have been much more numerous than in any other district during the course of the competition.

Class i.—Peasant Proprietors	...	...	...	218
Class ii.—Contractors	...	...	...	171

Twelve former prize winners have also entered in the Special Competition, so that Mr. Farfan has at present 401 competitors receiving instruction. Doubtless as in previous years a good many of these will drop out during the course of the year's work, but it is evident that the objects of the competition are now well known amongst those it is intended to benefit, and as the past reports of the judges show a large number of the competitors work well through the year and put into practice the advice of the Agricultural Inspectors with advantage to themselves and to the premier industry of the Colony. The chief need now is a larger staff of Inspectors to allow of good work being done continuously and over a greater area than is possible at present.

VEGETABLE COMPETITION.

The Board of Agriculture, as has already been announced, extended the scope of the competitions this year by offering prizes for vegetable cultivation.

Owing to various causes some of which are remediable the entries were not so numerous as hoped. In the Oropouche and Erin districts there are twenty-three competitors for the prizes for cassava and sweet potato cultivation, and in Brasso Piparo twenty-two in the various classes.

In order to give an additional encouragement to sweet potato cultivation, in view of the existing war conditions, the Board has decided to substitute for the prizes offered for bananas and pigeon peas a special additional prize of \$20 for the best acre or more in sweet potatoes in the Oropouche Erin districts; the entries in this competition to close by October 31.

W.G.F.

SCHOOL GARDENS IN CEYLON.

The Agricultural Department for India has recently published the *Fourth Report on the Introduction of Improvements into Indian Agriculture* to which is appended an account by Mr. C. Driberg, B.A., F.H.A.S., Secretary of the Ceylon Agricultural Society, of school garden work in that Colony.

"The following note will give an idea of what we have done in Ceylon for the sons of cultivators with a view to equip them better for their future life, and of the lines upon which the work so begun is developing.

"About ten years ago it was decided to adopt a scheme for establishing gardens in connection with Government vernacular schools, in order to give a practical side to the ordinary school curriculum.

"A start was made with a selection of half a dozen schools provided with facilities for gardening, viz., a suitable piece of land and a satisfactory water supply.

"Beginning in this small way the scheme gradually developed till to-day we have 250 school gardens distributed throughout the island.

"The scheme may be briefly described as follows:—

"About an acre of land attached to the school is set apart for the garden. Where no Crown land is available the District School Committee (of which the Chief Revenue Officer is Chairman) provides the required area by purchase or long lease, meeting the cost from a local fund.

"The cost of wire for fencing (say Rs. 25*) and of garden implements (say another Rs. 25) is met from the vote for school gardens allowed by Government, but the cost of erecting the fence, and where necessary for providing a water supply, is borne by the local authorities.

"The gardens are controlled by a superintendent, with the assistance of three inspectors (each of whom is in charge of a third of the island) who are constantly on tour, keeping the work going on proper lines.

"The garden itself is generally divided into three sections—an ornamental section in front of the school, an economic section consisting chiefly of vegetable plots, occupying the two sides, and a fruit section in the back ground.

"The necessary seeds and plants are mainly supplied from a stock garden in Colombo, where it is sought to exemplify all that is expected of a school garden and where new products are first tried before being sent out.

"The actual work of the school garden is done by the school children, and no paid labour is allowed. The work is generally done in the early morning before the regular school work begins—the garden being divided up among the different standards and the children working under the supervision of the teacher, his assistants and monitors.

"At first two difficulties were encountered—the prejudice of parents against their children engaging in manual labour, and the inexperience of teachers.

"The former soon gave way before the spontaneous interest which the children displayed in the outdoor work and the healthy competition which sprang up between different classes and between one school and another. The latter difficulty was minimized by the practical instruction imparted by the trained men who visited the gardens.

* One rupee equals 1s. 4d. or 32 cents.

"A course of nature study and elementary science combined with practical outdoor work was subsequently made part of the curriculum of the teachers under training, so that now teachers are better qualified for their duties under the new order of things.

"A further development is about to take place by providing a short special course of agricultural training for teachers after their course in the normal school, while from next year a set of agricultural readers will be introduced into Government vernacular schools. Last year school gardening was included in the Government educational code as a subject for grant, so that it may be expected that all private schools will take up the movement.

"As a result of the operation of the scheme for school gardens, the surroundings of our schools are being altered beyond recognition.

"Originally bare and uninviting, they are now bright and attractive.

"The outlook of the village school boy is being widened and his mind given that bent which is appropriate to him as a unit in the rural population; while through his daily experience in the growing and tending of plants he acquires a knowledge of the fundamental principles of agriculture. Incidentally the school garden is a means of introducing new plants—chiefly additions to the food supply—which the children help to disseminate in the villages.

"The produce of the garden is shared by the teacher and boys while there is also a vote for prizes for the best gardens—half the award going to the teacher and the other half being distributed among the three best workers.

"It will thus be seen that we are taking full advantage of the opportunity of working, through village school children (the most promising material), for the benefit of the rural population, and I think it will be admitted that the scheme is calculated to equip better these boys for the life before them, so that they would enter upon their business with a wider outlook upon the world and with a foundation of technical knowledge upon which to build.

"Within the next few years it is intended to establish a number of agricultural schools throughout the island, so that on leaving the ordinary village school the boys may have an opportunity of continuing, and so to speak specialising in agriculture. It is for these schools that we are getting four young men trained at the Poona Agricultural College."

Lantern Lectures.—The Board of Agriculture recently sanctioned the purchase of a lantern in order to facilitate the work of extending knowledge of pests and diseases by means of popular talks to employees on estates and other gatherings of agriculturists. At the September meeting of the Board Mr. Rorer reported that "Mr. Ulrich and I spent several days at Blanchisseuse in the latter part of July and delivered an illustrated lecture before the Blanchisseuse District Agricultural Society, dealing with the pests and diseases of the coconut palm. The lecture was very well attended. The new lantern ordered some time ago has been received, and we are planning to use it quite a good deal in the country districts. I have already arranged with the Warden for a lecture at Toco next month, and I am getting together material for lectures on some of the sugar cane estates."

AGRICULTURAL BANKS.

AGRICULTURAL SOCIETY'S REPORT.

THE Committee of the Agricultural Society appointed to consider the question of agricultural banks presented its report at the meeting of the Society held on September 11. The report which is printed in full in the *Proceedings of the Agricultural Society* XIV, August 1914, pp. 313-28, reviews the past history of this question, discusses the adverse majority report of the Government Committee of 1912-13, and concludes with the following recommendations:—

1. "That Agricultural Credit Societies of the Raiffeisen type be
"established in the Colony.
2. "That the necessary legislation be introduced as soon as possible,
"following generally the lines of the St. Vincent Agricultural
"Credit Societies Ordinance, 1913, including the amendments
"to the rules gazetted on August 21, 1913 and October 16,
"1913 with modifications to give effect to the following
"points.".....

These points are mainly matters of detail to render the Ordinance more suitable to local conditions and circumstances.

The report is now in the hands of an Official Committee appointed by His Excellency the Governor, and consisting of Hon. R. G. Bushe, C.M.G., Auditor-General (Chairman); Hon. L. A. Wharton, K.C., Acting Solicitor-General and Registrar of Friendly Societies; and Mr. W. G. Freeman, B.Sc., Acting Director of Agriculture.

CO-OPERATIVE BANKS IN INDIA.

THE following account of the progress of Co-operative Banks in India is taken from the *India Trade Journal*, XXXIII 1914. pp. 506-07:—

"The Co-operative Credit Societies Act (Act X of 1904) was passed on March 25, 1904, to encourage thrift, self-help, and co-operation among agriculturists, artisans, and persons of limited means. In March, 1912, this Act was repealed by the Co-operative Societies Act (Act II of 1912.) There are two classes of societies distinguished as non-agricultural and agricultural: a *non-agricultural society* is defined as a society in which not less than four-fifths of the members shall be non-agriculturists, and an *agricultural society* as a society in which not less than four-fifths of the the members shall be agriculturists. Each society consists of ten or more members above the age of 18 years residing in the same town or village or in the same group of villages, or belonging to the same tribe, class, caste or occupation.

"The following table, compiled by the Department of Statistics, India compares the position of registered societies in 1912-13 and in the four preceding years in all the provinces in British India except the North-West Frontier Province and Baluchistan; in the former the movement

has as yet made little progress, while in the case of the latter it has not yet been thought expedient to apply the Act."

	1908-09.	1909-10.	1910-11.	1911-12.	1912-13.
NUMBER OF SOCIETIES—					
Central ...	15	31	59	120	244
Agricultural ...	1,738	3,106	4,894	7,562	10,966
Non-Agricultural ...	210	291	368	495	582
Total ...	1,963	3,428	5,321	8,177	11,792
NUMBER OF MEMBERS					
	180,338	224,397	305,058	403,318	543,388
CAPITAL—					
	Rs.	Rs.	Rs.	Rs.	Rs.
Loans ...	40,80,436	64,87,315	1,12,81,153	1,98,87,310	3,24,08,064
Share capital...	13,71,123	21,49,644	31,59,595	50,58,037	79,05,935
Deposits by members	16,05,237	24,93,015	41,83,979	65,07,698	91,26,809
State aid ...	6,85,493	7,20,433	7,28,455	9,34,663	9,43,308
Reserve ...	1,90,929	3,30,620	5,51,320	9,92,454	15,55,622
Total ...	79,33,218	1,21,91,027	1,99,04,502	3,33,80,162	5,19,39,738
DISBURSEMENTS—					
Deposits repaid to members ...	7,39,227	10,29,115	20,45,671	40,39,974	92,40,603
Loans repaid...	23,98,625	28,48,465	41,08,588	96,36,223	1,61,10,337
Loans issued...	77,08,347	1,03,89,114	1,69,72,824	2,58,92,879	4,14,87,282
Interest paid on loans and deposits	2,27,584	4,59,889	7,82,508	13,10,193	21,92,458
Dividend and bonus paid..	45,309	63,325	1,14,182	1,41,701	2,02,113
Establishments and contingencies ...	75,139	1,10,440	1,58,135	2,60,652	4,25,379
Other items ...	10,26,807	9,05,553	14,15,086	13,73,783	26,83,324
Total ...	1,22,21,038	1,58,05,901	2,55,96,904	4,26,55,405	7,23,41,496

The financial figures are given in rupees. One rupee is equivalent to 1s. 4d. or roughly R.3 = \$1.00. It is worthy of note how comparatively small a proportion of the capital of these banks is derived from the Government. This is striking testimony to the soundness of the banks, indicating that private capitalists regard such co-operative banks as affording good security for loans. The St. Vincent Ordinance and the one proposed for this Colony are based on the same principles as the Indian Act.

OILS AND OIL SEEDS.

NOTES ON SOME OILS AND OIL PRODUCTS OF LOCAL INTEREST.

BY HERBERT S. SHREWSBURY, F.I.C., F.C.S.

Acting Government Analyst.

Before considering the features of some oil products of interest in Trinidad and Tobago, a brief account may be given of the chemistry of oils and fats.

NATURE OF OILS AND FATS.

Oils and fats are composed of a mixture of glycerides, that is compounds of glycerine with fatty acids. There exist several groups of fatty acids, the name recalling the fact that certain members of these groups occur in oils and fats. The best known series is the acetic acid group, the lowest member of which is formic acid, a pungent liquid with a boiling point 1°C higher than that of water. These acids are compounds of carbon, hydrogen and oxygen; formic acid contains the lowest percentage of carbon. With increasing percentage of carbon the members of the group pass from liquids with increasingly higher boiling points (acetic, propionic, butyric acid, etc.) to white crystalline solids of a fatty nature with practically no odour or taste and a generally inert chemical behaviour, altogether unlike that of the typical acid compound.

Of these solid fatty acids, palmitic and stearic are almost always present in oils and fats, existing as the glycerides palmitin and stearin.

Oleic acid belongs to another series of acids, but can readily be changed into stearic acid. It is an oily liquid similar to its glyceride olein which is also very rarely absent from oils and fats. Broadly speaking and with few exceptions, all oils and fats may be looked upon as mixtures of olein, stearin and palmitin, their properties depending on the proportions in which these glycerides occur.

The more liquid oils and fats contain heavy percentages of olein and on the contrary the more fatty the nature of an oil, *i.e.* the more nearly it approaches a solid instead of a liquid, the heavier will be its percentage of palmitin and stearin. The influence of olein is towards the production of a soft soap, whilst stearin and palmitin produce hard soaps.

Laurin should also be mentioned. It is the glyceride of lauric acid, a solid fatty acid containing less carbon than palmitic acid and belonging to the same group. It occurs in heavy percentages in the palm nut group of oils. Thus it is the essential and characteristic ingredient of coconut and palm nut kernel oils.

Many other glycerides are found in oils and fats, but usually in small quantities only. Thus butter fat is characterised by about 5 per cent. of butyrin and also contains traces of several other glycerides, whilst the great bulk of its substance is made up of olein, palmitin, and stearin. Linseed and other drying oils contain the glycerides of linolic and other acids, which confer their drying properties of this class of oil. The hard, white, crystalline fat from the seeds on *Oncoba echinata*, a Sierra Leone plant, contains 87 per cent. of the glyceride of chaulmoogric acid, which induces vomiting in certain animals.

Such instances may easily be multiplied but they do not affect the statement that generally speaking oils and fats may be considered as mixtures of olein, palmitin and stearin, and if this be remembered together with the necessary qualifications, the study of these bodies is greatly simplified.

The analytical constants of oils and fats give an approximate indication of the nature of their glycerides and the proportions in which they occur.

The following constants may be briefly explained :—

Acid Value.—The figure indicates the rancidity of the sample and is sometimes calculated to percentage of oleic acid. This acid forms a large proportion of the acids liberated when oils and fats become rancid. Rancidity is usually produced by the action on the sample of ferments called enzymes, bodies of albuminoid (protein) nature, of which lipase, present in castor seeds, is the most familiar example. Like all proteins their chemistry is extremely complex and will only be elucidated after years of investigation by many able chemists. These enzymes have the power of changing glycerides with the formation of their corresponding fatty acids.

It is of great importance to guard against the action of such bodies. They are of common occurrence in seeds and act energetically in conditions of moisture and moderate heat, and sometimes they are not brought into play unless the seed is bruised or crushed. If the oil cannot be prepared locally, seeds should be dried as carefully as possible. Desiccation is also inimical to moulds many of which have a similar fat splitting function, probably caused by the primary production of lipase-like ferments. Soap makers object to a high acid value, since it indicates a corresponding loss in the yield of glycerine, the most important bye-product of soap manufacture. The importance of these facts will be realized when it is remembered that oils and fats are the source of glycerine, which is the only bye-product from which nitro-glycerine can be manufactured. Nitro-glycerine (known as dynamite when absorbed in the "earth" kieselguhr) and nitrocellulose (gun cotton) are the chief ingredients of modern explosives whether used for industry or war. The prime importance of the acid value of oils and fats need not be further emphasized in the present state of affairs.

In lubricating oils a high acid value is fatal to the sample, as the free acids corrode metal. To illustrate these points, mention may be made of a sample of the crushed seeds of *Castilleja elastica* despatched from Trinidad to the Imperial Institute in 1903. The extracted oil gave the high acid value of 99.8 against 28.2 for oil extracted by carbon bisulphide in Trinidad and sent at the same time. Evidently enzymic action had been taking place in the crushed seeds during the voyage. In contrast to these high figures we have an acid value of 0.5 for a sample of coconut oil forwarded to the Imperial Institute in 1910 from Southern Nigeria.

This was a low acid value and indicated that the oil had been carefully prepared, although it had been somewhat overheated, as evidenced by the faint burnt smell produced in melting the sample. Care is also needed in this direction.

Saponification Value.—This figure indicates the amount of potash that actually combines with the fatty acids of an oil or fat and converts it into soap. The figure is to a certain extent specific, but considerable

variations occur amongst different samples of the same kind. The saponification values of the principal glycerides are given below :—

Stearin	...	...	163
Olein...	...	...	190
Palmitin	...	...	209
Laurin	...	...	264

It will be seen that a low saponification value suggests a high percentage of olein, but the interpretation is complicated by the low value for stearine, the presence of other glycerides, the existence of mono-, di-, and tri-glycerides of certain fatty acids and other considerations.

Iodine Value:—This indicates the extent to which unsaturated glycerides like linolin occur in a sample. It is these bodies which cause the drying properties of an oil and consequently the best drying oil (linseed) has the highest iodine value.

Valuation of Oil Products.—Vegetable oils and fats are generally obtained by the expression or extraction of plant seeds. In a few cases the oil is obtained from the fruit pulp, *e.g.* olive oil. The value of the seed depends largely on :

- (1) Value of oil or fat and its percentage.
- (2) Value of crushed cake as cattle food or fertiliser. Sometimes the cake is useless as food on account of the presence of toxic substances.

Oils and fats are conveniently divided into four groups :

Drying oils, semi-drying oils, non-drying oils, fats.

These terms are self-explanatory and need not be dwelt on. It may be mentioned that the distinction between oils and fats is largely a matter of temperature. For instance, coconut oil is truly an oil in the tropics and becomes a rather hard white fat in temperate climates.

OIL PRODUCTS OF LOCAL INTEREST.

A few notes are appended on oil products of local interest. The data are drawn from *Colonial Reports, Miscellaneous No. 88*. (Oilseeds, Oils, Fats and Waxes) issued by the Imperial Institute.

TUNG OR CHINESE WOOD OIL.

Mr. E. H. Wilson has shown (*Bulletin Imperial Institute* 1913, 11, 441) that the species *Alcurites Fordii* and *A. montana* are those to be considered and that commercial tung oil is mostly derived from *A. Fordii*.

A sample of the nuts sent from Hong Kong in 1906 arrived in a good state of preservation at the Imperial Institute. The kernels were fresh and in good condition. Unless special precaution had been taken, this, would indicate that little enzymic action occurs under these conditions but had the kernels only been sent, a different result might have been obtained, particularly had they been bruised or become damp.

The oil gave constants agreeing with commercial tung oil and a thin film dried to a varnish in one day at ordinary temperature. This indicates a high drying value, which is further shown by the iodine value of 167 (*cp.* linseed oil 170-194). The percentage of oil in the kernels and nuts respectively was 58.8 and 86.4. Evidently the nuts should be shelled and the kernels only exported, if this is feasible.

CANDLE NUT OIL.

Candle nut kernels are now exported from Fiji and elsewhere. They are obtained from the tree *Aleurites triloba*, Forst stated by the Superintendent of the Botanical and Forestry Department Hong Kong to be one of the best shade trees in that Colony.* Seeds were forwarded from Hong Kong and also from Mauritius. The kernels of the Hong Kong sample were nearly white and not discoloured, but the Mauritius seeds contained 18 per cent. of nuts with shrivelled or decomposed kernels. A possibility of enzymic action is suggested, but the deficiency of the Mauritius sample might have been due to other causes. The percentage of oil in the kernels was 60·8 equivalent to 19·8 in the unshelled seeds. As the shells are worthless they should certainly not be exported. An oil film took 10 days to dry at air temperature, although the sample gave an iodine value of 164 (*cp.* tung oil 167, linseed oil 170-194). This fact illustrates the complexity of oil chemistry. The probable reason for the superior drying power of tung oil (a film of which dried in one day) as compared with candle nut oil (drying in ten days) is a high percentage of drying glyceride, having drying properties out of proportion to the drying power indicated by the iodine value, which is merely an expression of the total amount of glycerides with more or less drying value, which are present in the oil.

The brokers advised a ready sale at £12 to £13 per ton (Oct. 1906) for the Hong Kong kernels and a value of £28 to £30 per ton for the oil extracted from the Mauritius sample. The cake was stated to have a small value as fertiliser (30/- to £2 per ton, Oct. 1911).

HEVEA BRASILIENSIS OR PARA RUBBER SEED.

The commercial future of this bye-product depends mainly on three factors :—

1. Cost of collection.
2. Efficient seed shelling.
3. Food value of cake.

Authorities differ on the first point, cost of collection of 1 ton kernels even having been calculated to a figure of £11 13 4, which is of course a prohibitive price.

A suggestion of Mr. H. N. Ridley F.R.S., formerly Director of the Botanic Gardens, Singapore may point the way to the problem's solution in various tropical countries. As regards the Straits Settlements, Mr. Ridley suggested that the right of seed collection in plantations might be leased to Chinese who would utilise the labour of village children.

The Imperial Institute's trial with Millers' nut cracking machine showed that it could be successfully used for seed shelling, but trials on a large scale with various machines are recommended. It is essential that kernels for export should not be broken or crushed. Para rubber seeds are a good example of seeds, which like castor seeds, contain the enzymic ferments previously noticed.

When the kernels are bruised, these bodies immediately begin to re-act, setting up hydrolysis of the oil, with the production of fatty acid and glycerine and resulting in the eventual loss of the latter. Thus the oil

* The tree is in cultivation in Trinidad and fresh supplies of seed have recently been imported from Hawaii. [Ed.]

from some crushed meal sent from the Straits Settlements gave the enormous figure of 65.6 per cent. of free fatty acids expressed as oleic.

Such an occurrence would ruin the product. The oil becomes valueless and the cake inedible.

Evidence so far collected is generally in favour of the possible production of a cake comparable in value to those in common use and closely resembling soy bean cake. The cake is high in percentage of proteins, carbohydrates and fat and low in crude fibre (food units 155 against soy bean cake 151).

Although the seed contains a cyanogenetic glucoside, the Imperial Institute found less than 0.01 per cent. of hydrocyanic acid in a sample of cake prepared from it; and it should be remembered that the favourite English cattle food (linseed cake) also contains a small percentage of a cyanogenetic glucoside in the seed from which it is prepared.

Feeding experiments conducted on cows and sheep for the Imperial Institute with Para rubber seed cake have been completely successful, the animals showing no abnormal symptoms but it is recommended that further experiments of a still more searching character should be tried in order to establish the merits of the food.

As regards the chemistry of the oil, it may be looked upon as an inferior linseed oil. In its constituents and general characters, it is very similar to this oil, but of weaker drying power, as suggested by its iodine value of 128 (cp. tung oil 167, candle nut oil 164, linseed oil 170-194).

CASTILLOA ELASTICA OR CENTRAL AMERICAN RUBBER SEEDS.

Crushed seed was sent from Trinidad in 1903, but the low percentage of oil (12.5) and the presence of a bitter principle which makes the cake inedible render castilloa seeds of doubtful commercial value. The properties of Para and Castilloa rubber seeds are compared below.

	<i>Para Rubber seed.</i>	<i>Castilloa elastica seeds.</i>
Oil per cent. in whole seed...	21.2	12.5
Appearance of oil ...	Clear, light yellow,	Semi-solid pale brown.
Value of oil cake ...	Probably equal to linseed cake	Inedible, due to bitter principle.
Enzymic character ...	Fat splitting enzyme present	Fat splitting enzyme present.
Free fatty acids per cent. (as oleic acid) in oil from good kernels ...	5.4	14.2
Free fatty acids per cent. (as oleic) in oil from crushed kernels undergoing hydrolytic action on voyage	65.6	50.2
Iodine value of oil ...	128	88
Saponification value of oil...	192	197
Nature of sodium soap from oil ...	Rather soft	Moderately hard.

Both kinds of seed contain hydrolytic ferments. The oils differ mainly in their iodine values and soap forming properties. Castilloa seed oil cannot even be classed as a semi drying oil, but produces a harder soap than Para rubber seed oil.

MAHOGANY SEED OIL.

This oil has a clear dark greenish yellow appearance and an unpleasant bitter taste. Its high percentage of olein is suggested by the saponification figure of 193 and its production of a soft soap. For this manufacture it could be employed, but it would not replace cotton seed oil for purposes of hard soap production. It is a very slow drying oil, iodine value (125) (*cp.* Para rubber seed oil 128, tung oil 167, candle nut oil 164, linseed oil 170-194), but might be used for paint mixing after extensive trials. Its probable value is that of soy bean oil (£26 per ton, 1911.) The oil was sent from Barbados in 1911.

PURGING OR PHYSIC NUTS.

These seeds of *Jatropha Curcas*, sent from Lagos in 1903 were valued at £4-£5 per ton. They yield a purgative oil of a yellow colour, a faint peculiar odour and a bland nutty flavour, which is used medicinally in India.

Although the product (known as *Curcas* oil) can be used in the soap, candle, and illuminating industries, it is only valued at £14 to £15 per ton, its glycerides occurring in too evenly balanced proportions to make it particularly valuable in any special direction. It may be used as a lubricant, but it is not very suitable on account of its semi drying properties. Iodine value 99 (*cp.* mahogany seed oil 125, para rubber seed oil 128, tung oil 167, candlenut oil 164, linseed oil 170-194). The cake is inedible on account of the purgative principle in the seed. The seeds are exported from Portuguese colonies to Lisbon where their oil is extracted.

OMPHALEA MEGACARPA SEEDS.

Attention is drawn to this very interesting product, a sample of which was sent from Trinidad to the Imperial Institute. The seeds were studied by Professor Cash F.R.S., and the favourable opinion of this eminent authority might make it possible to establish a market for their oil. The oil is pale yellow, faintly bitter, and resembles castor oil, although it is less viscous and without unpleasant taste.

Professor Cash regards it as a valuable non-irritant purgative, and states its dose to be 4 grammes (1 drachm or 1 teaspoonful) against the much larger official dose of castor oil (1 to 8 drachms).

Professor Cash further states that the seed's purgative properties are entirely due to the oil it contains, that it increases the peristaltic movements of the intestine by stimulating its intramural nervous plexuses and that it also increases urinary excretions, presumably by stimulating the kidney tissues, but that this mode of action is as yet not exactly determined. The kernels and the whole seed yield respectively 65 and 46.8 per cent. of oil. The seeds were derived from *Omphalea megacarpa*, Hemsl. (*O. diandra*), N.O. Euphorbiaceae.

COPRA.

An object lesson in the value of careful copra preparation is afforded by the condition of four samples on arrival at the Imperial Institute. Two were from Accra, Gold Coast. They were very dirty, had an unpleasant smell, and were in generally poor condition. A third came from Northern Nigeria, was mouldy and still covered with portions of the shell. The fourth sample from Southern Nigeria arrived in very good condition. It

consisted of shelled coconuts cut in half and dried; the inner surfaces were only slightly brown and free from mould and there was no odour or taste of rancidity. The first Gold Coast sample was valued at £18 17 6 to £19 per ton, the second at £5 less, with Straits Settlements copra at £23 10 per ton, (December 1910.) Improper attention in preparation, particularly lack of care in drying, accounted for the poor condition of these samples. Enzymic action had probably occurred.

The sample from Southern Nigeria was equal in appearance to the best grades of Ceylon produce, but its oil, though of good colour and odour, contained a higher percentage of free acids than Ceylon oil and was therefore of slightly less value.

COCONUT OIL.

A sample from Calabar (1910) was normal except for a faint burnt smell produced on melting, which indicated overheating of the oil. Care should be exercised in this direction. It was valued at £42 10 to £45 per ton, (April 1910). Interesting comparisons have been made between coconut oil and the service rifle oil at the Royal Small Arms Factory at Enfield. The comparison showed in favour of coconut oil after seven days keeping, but a large amount of fouling appeared on the barrels treated with coconut oil after keeping one month. It is therefore considered inferior to service rifle oil for the purpose of preserving gun barrels.

It is interesting to note that the samples used (sent by the Commissioner of the Imperial Department of Agriculture for the West Indies in 1904,) were Trinidad and Ceylon oils respectively, and yielded almost identical constants. The Trinidad oil contained slightly more free acids (4.9 per cent. against 3.4 per cent), but the oils were considered of equal value with regard to their gun barrel preserving properties.

CARAPA SEEDS.

The kernels of these seeds, *Carapa guianensis* yield 57 per cent. of a viscous, dirty brown oil, which is suitable for soap and candle manufacture. A bitter principle gives an extremely bitter taste to the oil and renders the cake inedible. Its value as a fertiliser is about £2 per ton.

The kernels are valued at £11 5 to £11 10 per ton (Nov. 1909).

LIVE STOCK.

"QUICKMATCH."

The thorough-bred Cleveland Bay stallion "Cholderton Luck" imported by the Department in 1918 for the Government Farm, Tobago, died on May 29, 1914, from pneumonia following a severe attack of influenza.

The thorough-bred "Marat" was temporarily sent over to Tobago, and the Department has since purchased from Messrs. Croney & Co. the thorough-bred "Quickmatch," who has already proved a good horse, a colt of his gaining the first prize in the show of stock held under the auspices of the Trinidad Breeders' Association, on the occasion of the Port-of-Spain June races this year.

"Quickmatch" realized \$5,000 as a yearling, and his full sister was bought at the Newmarket (England) sales in July, 1912, by Mr J. B. Joel, for 635 guineas (\$3,200 40). His sire's fee at present in France is \$1,000. "Quickmatch" is now standing for service at the Government Farm, Trinidad.

His pedigree is given below together with some notes of interest.

"Quickmatch." Half brother to "Quick" and "Explosion." Bay colt, foaled 1906. By imp. "Meddler." (Son of "St. Gatien" and "Busybody," by "Petrarch").

Out of imp. "Strike-a-Light II." (a stake winner and dam of "Quick") by "Donovan."

Out of "Fuse" (a stake winner a dam of "Vesuvian," "Long Tom," "You Go Off," "Percussion," "Plumcentre," etc.) by "Bend Or."

Out of "Fusee" (a stake winner and dam of imp. "St. Blaise," imp. "Candelmas," "Match Girl," "Go Bang," "Friar Rush," etc.) by "Marsyas," and so on to the 15th dam, by "Belgrade Turk."

Imp. "Strike-a-light II." was a winner at two and four years old, and is a half sister to "Vesuvian," who won the Dewhurst Plate, etc.

"Fuse" a stake winner, also foaled the winners "Long Tom," "You Go Off," "Percussion" and "Plumcentre," and was a half sister to the great winner and sire imp. "St. Blaise."

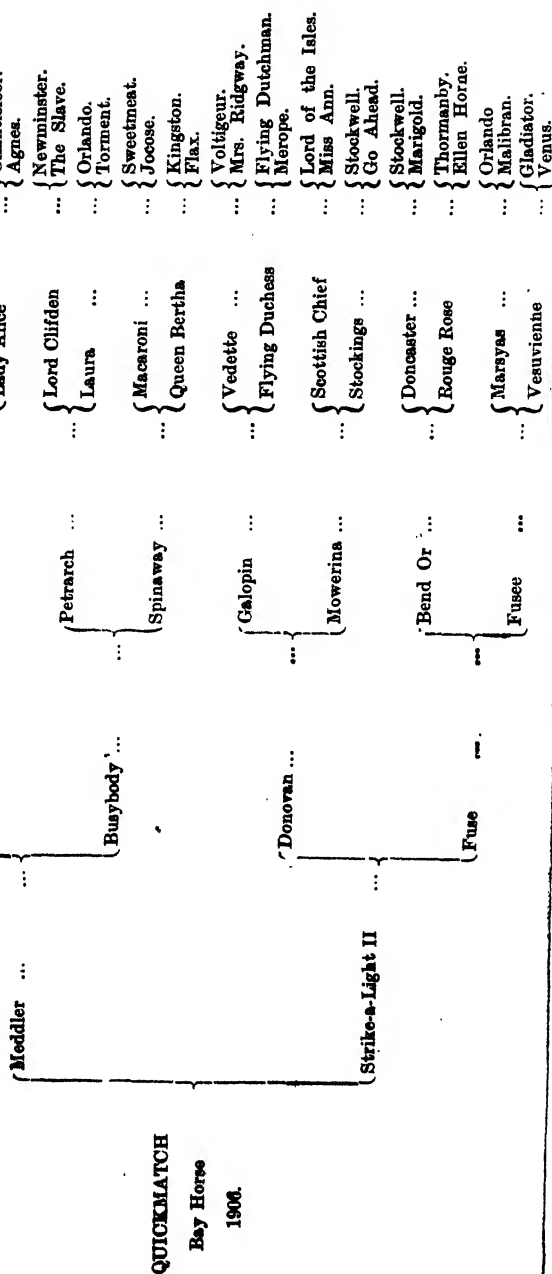
"Fusee," a great winner, also foaled imp. "Candelmas," "Friar Rush," and "Match Girl."

"Venus," the fourth dam, also foaled "Kalipyge," "Aphrodite," (1,000 guineas, etc.), "Agapemone," etc. It is a great racing family.

5th dam Venus	...	...	...	by Sir Hercules.
6th dam Echo	...	...	...	by Emilius.
7th dam mare	...	...	...	by Pioneer.
8th dam Canary Bird	...	...	...	by Sorcerer.
9th dam Canary	...	...	...	by Coriander.
10th dam Miss Green	...	...	...	by Highflyer.
11th dam Harriet	...	...	...	by Matchem.
12th dam Flora	...	...	...	by Regulus.
13th dam mare	...	...	...	by Bartlet's Childres.
14th dam mare	...	...	...	by Bay Bolton.
15th dam Belgrade Turk Mare	...	...	...

Bruce Lowe Family, No. 22.

Tabulated Pedigree of "Quickmatch."



* Rotherhill or the Rover. The Rover given.

METEOROLOGY.

RAINFALL RETURN FROM JANUARY TO SEPTEMBER 1914.

STATIONS.	July 1914.	July 1913.	Jan'y. to July 1914.	Jan'y. to July 1913.	August 1914.	August 1913.	Jan'y. to Aug. 1914.	Jan'y. to Aug. 1913.	Sept. 1914.	Sept. 1913.	Jan'y. to Sept. 1914.	Jan'y. to Sept. 1913.
<i>North West District.</i>												
St. Clair—Royal Botanic Gardens	5.05	2.86	17.84	12.59	9.15	6.48	26.99	19.07	7.80	6.52	34.79	25.59
Port-of-Spain—Colonial Hospital	4.49	3.20	15.52	10.75	4.19	4.88	19.71	15.63	7.60	6.59	27.31	22.22
" " Royal Gaol	4.87	2.50	16.22	12.34	5.10	5.44	21.32	17.78	8.71	6.51	30.03	24.29
" " Constabulary Head-quarters	4.46	1.77	17.06	11.12	5.71	4.78	22.77	15.90	5.14	5.70	27.91	21.60
St. Ann's—Reservoir	7.38	3.08	19.59	16.13	10.04	8.17	29.63	24.30	6.40	8.42	36.03	32.72
Maraval—Reservoir	5.87	5.83	20.26	19.47	7.57	13.64	27.83	33.11	7.07	9.20	34.90	42.31
" " Constabulary Station	7.79	7.11	23.00	24.40	6.02	16.05	29.02	40.45	9.30	10.29	38.32	50.74
Diego Martin	6.93	5.87	21.58	21.75	4.10	16.86	25.68	38.61	10.34	9.43	36.02	48.04
" " Waterworks	8.29	5.44	22.23	21.05	4.05	15.20	26.88	36.25	9.58	11.14	36.46	47.39
" " River Estate	8.84	5.91	22.95	21.57	4.74	16.10	27.69	37.67	9.21	11.14	36.90	48.81
Fort George Signal Station	5.44	5.08	20.43	17.27	11.89	9.03	32.32	26.32	5.32	6.56	37.64	32.88
North Post	8.54	4.34	20.43	17.41	4.86	11.34	25.29	28.78	7.42	8.65	32.71	37.43
Carenage Constabulary Station	6.98	5.58	27.05	21.36	13.33	8.44	41.19	30.80	5.85	5.22	47.04	39.02
Carrera Island Convict Depot	5.07	4.70	17.03	13.04	10.31	5.57	27.34	18.61	6.45	6.65	33.79	25.47
Chacachacare Light House	4.25	2.30	18.41	14.78	4.91	5.69	23.32	20.47	5.81	5.80	29.13	26.27
<i>Santa Cruz—Maracas District.</i>												
Santa Cruz Constabulary Station	10.13	7.09	25.22	24.39	1.82	10.43	27.04	34.82	7.71	11.08	34.75	45.90
St. Joseph, Government Farm	4.00	4.59	18.85	17.89	5.16	5.91	24.01	23.83	6.85	7.11	30.86	30.94
St. Joseph Constabulary Station	3.94	3.70	16.96	14.75	4.55	5.75	21.51	20.50	5.03	9.87	26.54	30.37
Tunapuna, St. Augustine Estate	3.58	7.06	17.80	18.40	4.28	6.36	22.08	24.76	6.73	8.98	28.81	33.74
Maracas—Government School	4.57	4.71	20.19	22.67	5.36	7.04	25.55	29.71	9.37	12.31	34.92	42.02
" " Orinola Estate	4.51	4.39	20.75	22.01	4.15	6.26	24.90	28.27	7.84	9.40	32.74	37.67
Caura, Wardour Estate	4.73	3.80	18.89	13.10	4.75	5.06	23.74	22.16	6.32	7.91	30.06	30.07
<i>West Central District.</i>												
Caroni, Frederick Estate	10.16	12.50	50.03	47.44	13.89	15.76	63.92	63.20	12.33	14.41	76.25	77.61
Chaguanas, Constabulary Station	1.70	6.40	18.35	24.77	5.92	8.97	24.27	33.74	9.64	11.70	33.91	45.44

RAINFALL RETURN FROM JANUARY TO SEPTEMBER 1914.—CONTINUED

STATIONS.	July, 1914.	July, 1913.	July, 1914, to July, 1914.	July, 1913, to July, 1913.	August, 1914.	August, 1913.	July, 1914, to Aug., 1914.	July, 1913, to Aug., 1913.	Sept., 1914.	Sept., 1913.	July, 1914, to Sep., 1914.	July, 1913, to Sep., 1913.
<i>West Central District.—Contd.</i>												
Chaguanas, Woodford Lodge Estate	3.28	6.45	20.49	23.83	5.98	9.00	26.47	32.83	9.62	12.13	36.09	44.96
Carapichaima, Waterloo Estate	3.31	5.27	20.01	25.11	3.41	6.89	23.42	32.00	7.05	9.52	30.47	41.52
Friendship Hall Estate	2.90	6.10	21.57	26.83	3.65	8.75	25.22	33.58	7.89	9.35	33.11	44.93
Couva, Exchange Estate	5.90	3.53	17.21	16.55	3.12	5.16	20.33	21.71	7.38	9.74	27.71	31.45
" Brechin Castle	5.00	4.17	20.01	21.08	3.45	7.23	23.46	28.31	9.15	10.49	32.61	38.80
" Perseverance	6.71	4.52	23.03	18.67	3.87	7.22	26.90	24.89	9.43	11.15	36.33	36.04
" Camden	4.09	3.99	15.98	21.30	3.43	5.37	19.41	26.07	6.41	9.34	25.62	36.01
" Milton	3.94	4.65	18.17	19.99	3.04	6.66	21.21	26.65	8.96	8.43	30.17	35.08
" Spring	1.17	5.57	19.46	24.64	3.96	6.40	23.42	31.04	6.74	9.07	39.16	40.11
" Constabulary Station	4.25	4.36	19.58	18.27	3.22	6.41	22.80	24.08	8.94	10.23	34.91	34.91
" Esperanza Estate, Savonetta	4.96	3.52	17.59	18.16	2.98	6.88	20.57	25.04	9.14	9.01	29.71	34.05
<i>San Fernando & Princes Town District.</i>												
Claxton's Bay, Forbes Park Estate	3.08	3.09	13.97	16.86	2.41	5.30	26.38	22.16	7.34	7.15	33.72	29.31
Pointe-à-Pierre, Bonne Adventure Est.	5.12	4.96	21.27	24.84	3.23	6.68	24.50	31.52	4.84	6.05	29.34	37.57
" " Concord Estate	5.12	4.60	21.96	24.27	3.24	6.35	25.20	30.02	6.65	7.03	31.85	37.65
" " Plein Palais Estate	4.02	5.00	16.31	21.77	3.11	5.00	19.42	28.17	8.96	5.95	28.38	34.12
Naparima, Picton Estate	5.39	2.90	17.66	14.44	3.15	5.00	20.81	19.44	5.99	7.63	26.80	27.07
" " Usine Ste. Madeleine Est.	5.99	7.81	18.99	31.04	2.93	7.24	23.82	38.28	7.76	7.62	31.58	45.90
" " La Fortunée Estate	6.45	6.23	20.91	20.67	3.01	4.47	21.92	25.14	5.79	7.90	27.71	33.04
" " Lewisville	6.50	5.03	22.97	27.30	4.40	6.65	27.37	33.95	7.64	8.69	35.01	42.64
" " Tarouba Estate	4.94	3.53	14.28	17.44	2.65	4.74	16.93	22.18	...	6.65	...	28.83
" " Union Hall Estate	6.04	5.77	19.41	21.12	2.63	5.21	22.04	26.33	6.11	7.41	33.74	33.74
" " Palmiste	6.03	6.33	19.44	22.94	3.62	7.40	23.56	30.34	7.53	7.99	31.09	48.33
" " Hermitage	5.97	5.35	19.56	18.95	3.82	5.33	23.08	24.28	6.44	9.96	29.52	34.24
Princes Town, Craignish Estate	7.19	4.41	27.22	23.48	4.66	7.65	31.88	31.13	5.24	5.47	37.12	36.60
" " Cedar Hill Estate	6.52	5.08	24.61	24.38	3.53	6.26	28.14	30.64	6.77	6.09	34.91	36.73
" " Williamsville Estate	7.70	4.27	25.67	24.18	4.01	5.96	29.68	30.14	5.54	7.63	35.22	37.77
" " Esmeralda Estate	6.62	4.45	25.54	27.92	4.55	7.42	30.09	35.34	8.21	5.22	38.33	40.56

RAINFALL RETURN FROM JANUARY TO SEPTEMBER 1914.—CONTINUED.

STATIONS.	July 1914.		July 1913.		Jan'y. to July 1914.		Jan'y. to July 1913.		August 1914.		August 1913.		Jan'y. to Aug. 1914.		Jan'y. to Aug. 1913.		Sept. 1914.		Sept. 1913.		Jan'y. to Sept. 1914.		Jan'y. to Sept. 1913.	
	Ins.	Inch.	Ins.	Inch.	Ins.	Inch.	Ins.	Inch.	Ins.	Inch.	Ins.	Inch.	Ins.	Inch.	Ins.	Inch.	Ins.	Inch.	Ins.	Inch.	Ins.	Inch.	Ins.	Inch.
<i>San Fernando & Princes Town District.</i>																								
Princes Town New Grant Estate	8.05	4.70	4.70	30.55	25.06	6.95	8.04	37.50	6.95	8.04	8.04	37.50	33.10	27.35	33.10	27.35	6.31	6.31	6.31	6.31	43.81	39.44	43.81	39.44
Constabulary Station	4.33	4.17	4.17	16.17	21.79	2.66	5.56	18.83	2.66	5.56	7.91	18.83	27.35	32.73	27.35	32.73	4.58	4.58	4.58	4.58	23.41	31.19	23.41	31.19
" " Hindutan Estate	7.01	4.73	4.73	26.79	24.82	4.99	7.91	31.78	4.99	7.91	9.58	31.78	32.73	47.49	32.73	47.49	8.13	8.13	8.13	8.13	36.50	39.54	36.50	39.54
" " La Retraite Estate	7.77	3.46	3.46	40.12	37.74	7.37	37.74	47.49	7.37	37.74	5.90	47.49	29.33	29.33	29.33	29.33	5.06	5.06	5.06	5.06	34.19	34.39	34.19	34.39
Sav. G'de, Friendship & Ben Lomond Ests.	6.42	3.91	3.91	25.04	23.43	4.15	5.90	29.19	4.15	5.90	6.39	29.19	28.35	28.35	28.35	28.35	8.77	8.77	8.77	8.77	34.38	34.44	34.38	34.44
Poole, El Rosario Estate	5.46	4.79	4.79	21.15	21.96	4.46	6.44	40.46	4.46	6.44	6.80	40.46	44.50	44.50	44.50	44.50	6.69	6.69	6.69	6.69	47.13	53.37	47.13	53.37
7.09	5.57	5.57	34.03	37.70	37.70	6.44	6.80	40.46	6.44	6.80	6.80	40.46	44.50	44.50	44.50	44.50	6.69	6.69	6.69	6.69	47.13	53.37	47.13	53.37
<i>Montserrat District.</i>																								
Montserrat, Constabulary Station	3.87	4.57	4.57	20.50	24.78	3.52	7.83	24.02	3.52	7.83	7.83	24.02	32.61	42.89	32.61	42.89	7.65	7.65	7.65	7.65	31.67	40.66	31.67	40.66
Brasso, La Vega Estate	4.54	8.11	8.11	26.03	32.95	4.06	9.94	20.09	4.06	9.94	9.94	20.09	42.89	42.89	42.89	42.89	8.43	8.43	8.43	8.43	28.52	50.83	28.52	50.83
<i>Arima District.</i>																								
Arima, Warden's Office	2.35	4.05	4.05	19.56	19.00	5.64	8.32	25.20	5.64	8.32	8.32	25.20	27.32	40.18	27.32	40.18	7.54	7.54	7.54	7.54	32.74	33.94	32.74	33.94
Arima, Torreilla Estate	4.94	5.92	5.92	31.40	29.74	9.48	10.44	40.88	9.48	10.44	10.44	40.88	40.18	33.09	40.18	33.09	6.15	6.15	6.15	6.15	47.03	50.39	47.03	50.39
Arima, Verdant Vale Estate	6.34	4.82	4.82	30.23	28.27	5.93	9.82	36.16	5.93	9.82	9.82	36.16	33.09	33.09	33.09	33.09	8.20	8.20	8.20	8.20	44.36	48.62	44.36	48.62
San Rafael, Constabulary Station	4.58	7.37	7.37	33.94	35.37	8.55	14.68	42.49	8.55	14.68	14.68	42.49	50.05	50.05	50.05	50.05	11.94	11.94	11.94	11.94	54.43	64.11	54.43	64.11
Guanapo, Talparo Estate	4.18	8.06	8.06	28.08	34.99	9.41	12.24	37.40	9.41	12.24	12.24	37.40	47.23	47.23	47.23	47.23	7.35	7.35	7.35	7.35	44.84	61.12	44.84	61.12
San José Estate, Guanapo	5.63	8.22	8.22	36.37	40.59	8.90	15.23	46.00	8.90	15.23	15.23	46.00	55.82	55.82	55.82	55.82	6.71	6.71	6.71	6.71	52.46	68.94	52.46	68.94
Tamana, Santa Marta Estate	5.63	8.22	8.22	36.37	40.59	8.90	15.23	46.00	8.90	15.23	15.23	46.00	55.82	55.82	55.82	55.82	6.71	6.71	6.71	6.71	52.46	68.94	52.46	68.94
<i>South-West District.</i>																								
Oropuche, Constabulary Station	8.83	6.25	6.25	28.86	23.86	5.88	6.38	34.74	5.88	6.38	6.38	34.74	30.44	30.44	30.44	30.44	5.80	5.80	5.80	5.80	40.54	37.81	40.54	37.81
" " Pluck Estate	6.50	3.04	3.04	19.80	17.64	3.58	4.27	23.38	3.58	4.27	4.27	23.38	31.91	31.91	31.91	31.91	5.67	5.67	5.67	5.67	29.05	38.32	29.05	38.32
Siparia, Constabulary Station	12.23	6.67	6.67	33.22	30.55	6.25	9.22	39.47	6.25	9.22	9.22	39.47	39.77	39.77	39.77	39.77	7.65	7.65	7.65	7.65	47.12	52.43	47.12	52.43
Guapo, Adventure Estate	7.62	6.10	6.10	23.47	20.47	5.41	7.26	28.88	5.41	7.26	7.26	28.88	40.73	40.73	40.73	40.73	8.08	8.08	8.08	8.08	36.96	35.58	36.96	35.58
Cap-de-Ville, Constabulary Station	15.05	5.51	5.51	37.76	28.53	7.38	11.90	45.14	7.38	11.90	11.90	45.14	40.43	40.43	40.43	40.43	9.81	9.81	9.81	9.81	54.95	54.12	54.95	54.12
Erin, La Resource Estate	8.01	7.99	7.99	37.76	30.33	4.97	11.28	32.25	4.97	11.28	11.28	32.25	41.61	41.61	41.61	41.61	5.19	5.19	5.19	5.19	37.44	43.91	37.44	43.91
" " Industry Estate	9.16	7.99	7.99	30.78	30.33	6.73	6.73	32.25	6.73	6.73	6.73	32.25	41.61	41.61	41.61	41.61	5.36	5.36	5.36	5.36	42.87	43.91	42.87	43.91
Cedros, Constabulary Station	6.91	4.62	4.62	25.52	20.66	6.42	4.96	37.51	6.42	4.96	4.96	37.51	25.62	25.62	25.62	25.62	5.73	5.73	5.73	5.73	37.67	28.80	37.67	28.80
" " Perseverance Estate	6.71	...	...	23.16	...	5.20	...	28.36	5.20	...	...	28.36	...	...	...	...	7.62	7.62	7.62	7.62	35.98	...	35.98	...

RAINFALL RETURN FROM JANUARY TO SEPTEMBER, 1914.—Continued.

STATIONS.	July 1911.		July 1913.		Jan'y. to July 1914.		Jan'y. to July 1913.		August, 1914.		August, 1913.		Jan'y. to Aug. 1914.		Jan'y. to Aug. 1913.		Sept. 1914.		Sept. 1913.		Jan'y. to Sept. 1914.		Jan'y. to Sept. 1913.	
	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	
Icaacos, Constance Estate	6.96	1.57	6.04	22.38	24.48	4.44	6.35	26.82	30.83	3.58	6.74	30.40	37.57	23.07	44.33	37.90	41.27	32.10	4.67	9.27	32.10	44.33	37.90	
Irois, Irois Estate	11.64	6.04	32.92	17.15	17.22	25.27	14.27	5.30	6.35	26.82	30.83	3.58	6.74	30.40	37.57	23.07	41.27	32.10	4.67	9.27	32.10	44.33	37.90	
Siparia, Alta Gracia Estate	7.94	4.35	22.38	39.01	41.81	4.46	8.25	35.47	54.23	6.80	6.65	41.27	60.88	82.92	55.13	47.95	34.13	4.91	4.76	19.27	26.04	37.57	23.07	
South <i>Co. rd.</i>																								
Moruga, Constabulary Station	8.61	8.04	39.01	37.15	48.62	8.25	12.37	33.23	48.61	7.10	13.95	52.50	82.92	55.13	47.95	34.13	4.91	4.76	19.27	26.04	37.57	23.07	23.07	
North <i>Co. rd.</i>																								
Blanchisseuse, Constabulary Station	8.45	6.52	26.98	36.24	34.94	5.20	2.76	4.12	17.52	21.28	1.75	3.74	41.67	67.11	53.38	37.31	30.72	6.68	10.93	30.72	37.31	30.72	37.31	
Grande Riviere, Mon Plaisir Estate	5.62	4.72	34.94	17.16	17.16	2.76	4.12	17.52	21.28	1.75	3.74	41.67	67.11	53.38	37.31	30.72	6.68	10.93	30.72	37.31	30.72	37.31	30.72	
Toco, Aragua House	5.53	3.69	25.48	14.76	14.76	2.76	4.12	17.52	21.28	1.75	3.74	41.67	67.11	53.38	37.31	30.72	6.68	10.93	30.72	37.31	30.72	37.31	30.72	
" Constabulary Station	4.20	0.50	14.76	17.16	17.16	2.76	4.12	17.52	21.28	1.75	3.74	41.67	67.11	53.38	37.31	30.72	6.68	10.93	30.72	37.31	30.72	37.31	30.72	
Point Galera, Light House																								
East Coast.																								
Matura, La Juana Estate	7.00	9.49	32.25	31.07	37.37	11.96	8.82	40.87	46.19	7.51	13.74	48.80	73.38	59.93	69.45	66.60	53.27	16.80	9.78	47.68	55.39	71.85	67.11	
Manzanilla, Constabulary Station	6.21	6.23	31.07	41.28	41.28	8.20	12.76	40.62	56.82	7.41	14.85	55.39	71.85	67.11	53.38	37.31	30.72	6.76	13.73	49.87	31.39	41.67	41.67	
Sangre Grande, Sta. Estrella Estate	5.70	7.95	32.42	44.06	44.06	8.20	12.76	40.62	56.82	7.41	14.85	55.39	71.85	67.11	53.38	37.31	30.72	6.76	13.73	49.87	31.39	41.67	41.67	
New Lands Estate	6.92	8.40	36.85	41.90	41.90	8.20	12.76	40.62	56.82	7.41	14.85	55.39	71.85	67.11	53.38	37.31	30.72	6.76	13.73	49.87	31.39	41.67	41.67	
" Evasdale Estate	6.21	7.96	33.08	30.83	30.83	10.08	6.86	27.63	37.19	3.74	4.48	31.39	41.67	41.67	41.67	41.67	41.67	41.67	41.67	41.67	41.67	41.67	41.67	
" Grosvenor Estate	4.99	4.82	22.23	18.52	18.52	5.42	5.82	23.29	23.72	4.01	7.10	27.30	30.82	30.82	30.82	30.82	30.82	30.82	30.82	30.82	30.82	30.82	30.82	
Mayaro, Constabulary Station																								
Tobago.																								
Tobago, Hermitage Estate	7.54	8.66	28.92	38.05	38.05	4.41	9.34	32.43	47.39	7.85	9.78	40.28	57.17	37.90	47.94	47.94	47.94	47.94	47.94	47.94	47.94	47.94	47.94	
" Riversdale	4.89	4.64	15.95	23.25	23.25	5.09	7.13	29.95	41.28	4.88	7.52	25.42	37.90	37.90	37.90	37.90	37.90	37.90	37.90	37.90	37.90	37.90	37.90	
" King's Bay	6.48	6.86	25.28	32.67	32.67	4.67	8.61	29.95	41.28	6.96	6.66	36.91	47.94	47.94	47.94	47.94	47.94	47.94	47.94	47.94	47.94	47.94	47.94	
" Roxburgh	7.38	8.92	30.82	38.62	38.62	4.62	9.71	35.44	48.33	7.93	9.13	43.37	55.13	55.13	55.13	55.13	55.13	55.13	55.13	55.13	55.13	55.13	55.13	
" Lure	8.22	7.91	34.06	36.61	36.61	5.02	8.07	39.08	41.68	6.68	10.45	45.74	55.13	55.13	55.13	55.13	55.13	55.13	55.13	55.13	55.13	55.13	55.13	
" Botanic Station	6.57	4.21	20.94	20.15	20.15	4.48	7.13	25.42	27.28	5.80	10.93	30.72	37.31	37.31	37.31	37.31	37.31	37.31	37.31	37.31	37.31	37.31	37.31	
" Government Farm	4.19	3.11	10.64	13.65	13.65	2.73	5.41	13.37	19.06	3.93	6.63	17.30	25.69	25.69	25.69	25.69	25.69	25.69	25.69	25.69	25.69	25.69	25.69	
" Lowlands Estate	4.39	2.43	15.42	17.50	17.50	4.25	4.96	19.67	22.46	4.48	8.26	24.15	30.72	30.72	30.72	30.72	30.72	30.72	30.72	30.72	30.72	30.72	30.72	
" Friendship Estate	5.23	3.11	18.52	17.30	17.30	4.77	5.82	23.29	23.72	4.01	7.10	27.30	30.82	30.82	30.82	30.82	30.82	30.82	30.82	30.82	30.82	30.82	30.82	

NOTES.

Early in August, owing to the uncertainty as to which port the mail steamers would discharge cargoes in England, and consequent delay and possible loss of perishable products His Excellency the Governor approved of the Royal Mail Steam Packet Company issuing a notice that fruit would not be accepted. Later a consignment was taken but the prices realised were very poor. As shipments are likely to be very small until affairs are more settled, the Company has again sought and obtained the Governor's permission to cease carrying fruit until further notice.

The Board of Agriculture has recently suffered the loss of Messrs. J. Moodie and F. J. Morris.

Mr. Moodie has been a member of the Board since its foundation in March, 1908. On the receipt of his resignation His Excellency the President in the name of the Board said that they regretted exceedingly Mr. Moodie's decision on account of the keen interest he has always taken in all matters and that should he see his way at any future date to become a member again, the Board would be only too pleased to re-appoint him." The Secretary was directed to forward a copy of the above resolution to Mr. Moodie.

Mr. Morris was a comparatively new member of the Board, although he had "acted" previously; his resignation owing to leaving the Colony was also regretted.

Two welcome co-operative movements are in progress. The Agricultural Society which has held numerous exhibitions during its existence is being helped for the exhibition in February, 1915, by the Board of Agriculture, which has contributed \$500 to the prize fund. There is a joint Executive Committee with Mr. W. G. Freeman as Chairman. The other case is the joint Exhibition of the recently founded Horticultural Club and Poultry and Pet Stock Association. This will be held on December 4 and 5, and the proceeds devoted to the War Funds.

At the July meeting of the Board of Agriculture it was decided that the Entomologist's recommendations in Circular No. 12, letter of transmittal, with the deletion of No. 4, be recommended to the Government. The Agricultural Society's recommendation to the Government to have mongoose destroyed on Crown Lands adjoining private properties was also recommended by the Board which advised that the Wardens might be supplied with traps and also authorized to employ trappers in their respective districts. The Board strongly recommended that no premiums be paid for mongoose.

For the Circular and Letter referred to see *Bulletin* XIII, June, 1914, pp. 196-204.

Mr. W. E. Broadway formerly Curator of the Botanic Station, Tobago, has been appointed Horticulturist and Assistant Botanist as from July 1, 1914, and transferred to Trinidad as his head-quarters.

Mr. H. Meaden has been appointed officer-in-charge of the Botanic Station, Tobago, as from July 1, 1914, remaining also Manager of the Government Farm, Tobago.

BULLETIN

OF THE
DEPARTMENT OF AGRICULTURE,
Trinidad and Tobago.

VOL. XIII.]

NOVEMBER-DECEMBER, 1914.

[No. 84.]

SUGAR.

GREAT BRITAIN'S SUGAR SUPPLY.*

THE following figures, recently published by the Chairman of the Council of the Incorporated Beet Sugar Pioneer Association, (England) are deserving of the attention of all cane-sugar producers within the Empire.

Beet sugar imported during 1912 into the British Isles from six continental centres :

			<i>Refined (tons).</i>	<i>Raw (tons).</i>
Germany	...	...	458,500	440,600
Austria	...	...	175,700	148,500
Holland	...	...	189,400	28,400
Belgium	...	...	64,900	27,700
France	...	...	35,200	634
Russia	...	...	9,200	...
Denmark	...	...	...	35,500
			<u>927,900</u>	<u>681,334</u>

Values at average prices for 1913 f.o.b. Foreign ports.

927,900 tons at £12	...	- £ 11,134,800
681,334	£ 9 10	... - £ 6,472,678

£ 17,607,478

Germany and Austria's share of this trade amounts to £13,149,000 the greater part of which, if not the whole, may be diverted in future to other countries.

In Britain the cultivation of beet for sugar production will probably receive a larger share of attention than hitherto, and cane-sugar producers should not lose this opportunity to call attention to the superiority of cane sugar. The recent Antarctic Expedition under Sir Ernest Shackleton took a supply of cane sugar after an expert investigation of the relative merits of cane and beet sugar. It would be of great assistance to cane sugar producers to be informed of the nature and extent of this investigation.

For many years the beet sugar producers have educated the public to believe that a pure and white sugar, whatever its source may have been, meets all the requirements of the most fastidious consumers. The public have not been told that beet sugar is not fit for consumption unless the natural impurities are reduced by manufacturing processes to a very small percentage. Cane sugar containing even a large percentage of natural impurities is never unpalatable. The residual impurities in beet sugar, though small in amount, must be of the same nature as the original impurities, and no one yet knows what effects upon health may be produced by consuming the last traces of the residual impurities of beet sugar. It is known that beet sugar of 94 per cent. purity develops an odour as offensive as that of a decomposed egg and that the elimination of another

* Read at a meeting of the Board of Agriculture on November 20, 1914.

5 per cent. of the natural impurities is a commercial necessity. If this fact were more widely known, consumers would probably be led to realise the inferiority of beet sugar.

The sweetening power of cane sugar is known to exceed that of beet sugar.

Yellow crystals, as produced in Demerara and Trinidad, have for a long time been imitated by the addition of an aniline dye to white beet sugar, and the extensive sale of this substitute has been very detrimental to the interests of manufacturers of yellow crystals. The West India Committee has made laudable efforts to protect the latter, and the present opportunity is a favourable one for the continuance and extension of these efforts.

The planters in the West Indies should, I think, make an early and serious attempt to capture a share of the £18,000,000 that was formerly paid annually to Germany and Austria for a sugar of inferior quality. I sincerely hope that the present price of sugar will induce our planters and cane farmers to cultivate larger areas of canes for the next crop and thus assist in the displacement of beet sugar. The world's production of cane sugar is now about 9,000,000 tons as compared with 6,800,000 tons of beet sugar. The production for the years 1907, 1908, 1909 and 1910 has been published in a Board of Trade White paper (1911) and are for the under-mentioned countries as follows :—

PRODUCTION OF RAW BEET SUGAR.

<i>Country.</i>	<i>1907 tons.</i>	<i>1908 tons.</i>	<i>1909 tons.</i>	<i>1910 tons.</i>
Germany ...	2,206,012	2,104,358	2,045,805	2,004,653
Russia ...	1,391,923	1,522,384	1,522,041	1,255,345
Austria ...	1,001,686	1,116,707	1,079,473	1,225,589
Hungary ...	303,766	266,622	276,147	...
Holland ...	201,819	176,635	215,224	191,691
Belgium ...	277,817	227,830	253,220	244,411
France ...	754,746	734,291	793,436	802,341
Sweden ...	150,798	110,188	134,497	124,959
Denmark ...	51,814	65,230	64,398	68,955
Italy ...	104,673	133,781	162,655	109,014
Spain ...	98,144	106,612	108,232	81,666
Other European Countries ...	29,174	34,862	37,675	45,595
Total for Europe...	6,566,872	6,598,850	6,692,803	6,149,219
United States ...	482,234	418,950	384,010	457,562
Total estimated quantity of Raw Beet Sugar produced in Europe and the United States ...	6,999,106	7,012,800	7,076,813	6,606,781

PRODUCTION OF RAW CANE SUGAR.

<i>Country. In British Empire.</i>	<i>1907 tons.</i>	<i>1908 tons.</i>	<i>1909 tons.</i>	<i>1910 tons.</i>
Mauritius... ..	181,526	181,834	198,214	244,597
Commonwealth of Australia	217,479	165,715	147,470	149,334
Fiji	68,334	66,137	63,942	68,900
Natal	24,223	31,993	77,491	76,000
West Indies	152,897	139,774	109,316	118,103
British Honduras ...	615	605	410	400
British Guiana ...	100,737	115,212	108,533	101,843
British India ...	2,205,300	2,046,900	1,872,900	2,125,300
	<hr/>	<hr/>	<hr/>	<hr/>
Total British Empire (including India) ...	2,951,111	2,748,170	2,583,276	2,814,477
	<hr/>	<hr/>	<hr/>	<hr/>
<i>In Foreign Countries.</i>	<i>1907 tons.</i>	<i>1908 tons.</i>	<i>1909 tons.</i>	<i>1910 tons.</i>
United States	243,000	352,000	325,000	335,000
West Indies (other than British)	1,776,134	1,355,314	1,939,665	2,308,302
South America	548,598	535,331	620,335	587,829
Dutch East Indies (Java)	1,062,795	1,114,186	1,189,420	1,200,618
Hawaiian Islands ...	464,677	477,190	489,357	462,613
Other Foreign Coun- tries	599,105	636,861	710,688	881,624
	<hr/>	<hr/>	<hr/>	<hr/>
Total Foreign Coun- tries	4,694,309	4,470,882	5,274,465	5,775,986
	<hr/>	<hr/>	<hr/>	<hr/>
Total estimated pro- duction of Cane Sugar	<u>7,645,420</u>	<u>7,219,052</u>	<u>7,857,741</u>	<u>8,660,463</u>

REGULATIONS FOR IMPORTATION OF SUGAR INTO THE UNITED KINGDOM.

The Trinidad *Royal Gazette* of November 19, 1914, contains the following notice :—

GOVERNMENT HOUSE,
November 7, 1914.

The Governor directs it to be notified for general information that, except in the cases hereinafter mentioned, no sugar will be admitted into the United Kingdom without a license from the authorities in the United Kingdom. Shippers of sugar from this Colony should therefore take measures to obtain such a license. The exceptions to this general prohibition are that no license to import Trinidad sugars into the United Kingdom will be required :—

- (a.) If the sugar was cleared from Trinidad on or before October 26, 1914; or
- (b.) If the sugar is shipped from Trinidad under a contract made prior to August 4, 1914.

By Command,

S. W. KNAGGS,
Colonial Secretary.

This notice is in accordance with a Proclamation by His Majesty the King, dated October 26, 1914. The reason for the regulations is clearly summarized in the following official statement published in England on October 24 and reprinted in the *West India Committee Circular* for November 3 :—

“A new and most important advance has been made by the Government in their efforts to bring economic pressure to bear upon Germany. Measures familiar to the public have already been taken to prevent the import into Germany and Austria of goods necessary in the conduct of the war. Much has been achieved in this direction, but when neutral countries have the opportunity of making great profits on the enhanced prices which Germany and Austria are willing to pay, it is impossible to put a stop to all importation. There is, however, one further step which can be taken to minimising the German power to buy. At the present time there are but few exports of great value which can be sent out in exchange for the goods Germany receives from neutral countries. Of these sugar is the chief. Already the exchanges are rising rapidly against Germany and Austria, and if the export of sugar could be prevented or rendered unprofitable, a further serious blow would be struck at their trade.

“The import into this country of alien goods is, of course, already prohibited. German and Austrian sugar may not be imported here under its true colours; but if it be first exported to a neutral country and then re-exported from the neutral country to Great Britain, it passes as innocent, and the British purchasers unconsciously give vital assistance to German trade. Already advices have been received that bids for German sugar are being greedily sought in neutral countries. Even if this enemy sugar did not come back to this country—though there is good reason to believe that this traffic has in fact begun—it would set free a corresponding amount of sugar in the neutral country which might be shipped to the United Kingdom. In the first case, we should be buying enemy sugar itself; in the second case we should be buying enemy sugar at one remove. The only ultimate big market for this sugar is the United

Kingdom, and nothing less than the total prohibition of the import of sugar into this country will hinder the German and Austrian export. In ordinary circumstances such a prohibition would be inconceivable, but the large purchases which the Sugar Commission have made assure ample supplies for British consumption for many months to come. The United Kingdom is secure from danger of a shortage of sugar. The price at which it has been bought permits the retail sale without loss at a rate below that now current. It is now generally sold at not more than 3½d. per lb. for granulated sugar, and a reduction in this price may be expected.

"In these circumstances the Government have decided to prohibit for the time being, the import of sugar, with the object of defeating the German and Austrian effort to turn their stocks into money."

This announcement was followed by the Proclamation referred to above.

Meanwhile the following letter dated October 24 had been sent by the West India Committee to Mr. McKenna:—

"Sir:—With reference to the official announcement published to-day to the effect that the Government have decided to prohibit the import of sugar. I am to express the earnest hope that such prohibition may not be extended to British West Indian sugar.

"Apart from other considerations which would render the prohibition of the importation of sugar from the British West Indies and British Guiana extremely prejudicial, it may be pointed out that a class of grocery sugar is manufactured in those colonies expressly for the London market and that it would be impossible to dispose of such sugar elsewhere."

I have, etc.,

(Sgd.) ALGERNON E. ASPINALL,
Secretary.

On October 28 a further letter was written by the West India Committee to Mr. McKenna in the following terms:—

"Sir,—On Saturday last, October 24, I wrote to you with regard to the decision of the Government to prohibit the import of sugar, and expressed the earnest hope that such prohibition might not be extended to British West Indian sugar. Since then my Committee have seen the terms of the proclamation on the subject, dated October 26, and have noted that all sugar except those (a) cleared from the port of shipment to this country on or before October 26, 1914 or (b) imported under contract made prior to August 4, 1914, are included in the prohibition though licenses to import may be given by a Secretary of State or the Board of Trade to individuals or a class of persons.

"2. I was yesterday informed by the Secretary of the Royal Commission over the telephone, that applications for such licenses would be judged on their merit.

"3. In view especially of the fact that, as we pointed out to you in a letter of the 24th instant, a class of grocery sugar is manufactured in the British West Indies and British Guiana expressly for the London market, and that it would be impossible to find a market for it elsewhere, my committee desire me again most strongly to urge that the prohibition may be withdrawn in the case of British West Indian sugar.

"4. My Committee conceive that the only possible grounds on which His Majesty's Government could decide that the imports of sugar from British Colonies should be prohibited would be the possibility of sugar from

enemy countries coming to this market through British Colonies, or displacing sugar in the colonies which would then be free to come here. But this contingency could be guarded against by certificates of origin accompanying the shipments of the sugar, and the prohibition in the Colonies of the importation of sugar from enemy or even neutral countries.

"5. From the point of view of the manufacturers of grocery West Indian sugar, the position is particularly serious. The trade in this class of sugar which is commonly known as "Demerara sugar," is now firmly established. For years my Committee have taken measures to protect this genuine Demerara sugar from dyed imitations, both beet and cane, and it is obvious that their work will have been in vain and that the trade in the genuine article will be lost if any restrictions are put upon the importation of Demerara sugar. You will, Sir, I feel sure, appreciate that it would be a grave injustice thus to kill a legitimate Colonial industry which it would take years to re-establish.

"6. The Secretary of the Royal Commission suggested, in the conversation over the telephone above referred to, that West Indian grocery sugar might be sent to Canada; but in view of the fact that in that Dominion sugar is assessed for duty purposes according to the Dutch Standard, this is impossible as the duty would be prohibitive; besides, there is no market for this class of sugar there. The suggestion that it might be sent to France is equally impracticable, for experience has shown the extreme difficulty of establishing in a market a sugar to which that market is not accustomed. But even if it were possible to find other markets for Demerara sugar, my Committee would view with grave concern the interruption of a trade with this country which has been established for many years.

"Trusting that in the circumstances the prohibition may be removed in the case of British West Indian sugar."

I have, etc.,

(Sgd.) ALGERNON E. ASPINALL,

Secretary.

The following reply to the Committee's letter of October 24, was received on October 28, from Sir Henry Primrose, Chairman of the Royal Commission on the Sugar supply.

"Sir,—Mr. McKenna has asked me to reply to your letter of the 24th instant.

"He quite recognises the special considerations which attach to the application to the British West Indies and British Guiana of the prohibition on the import of sugar to this country. But the Government are advised that the Prohibition must, under the existing law, be universal in respect of countries of origin, and it was not therefore possible to except from its operation even our own Dominions. The Order in Council does however permit of the issue of licenses to import in approved cases, and Mr. McKenna hopes that by the exercise of this power it will be possible to meet the case of the class of sugar which you indicate as being manufactured in the West Indian Colonies specially for the market of the United Kingdom."

I am, etc.,

(Sgd.) H. W. PRIMROSE.

BRITISH GROWN SUGAR.

Mr. F. I. Scard, F.I.C., formerly of British Guiana, contributes under the above title an interesting article to *The Grocer* of September 26, 1914 (Vol. CVI, 674-75) in the course of which he reviews briefly the efforts to produce beet sugar in England. The first attempt was made in 1831 at Ulting near Maldon in Essex. This and a subsequent venture at Lavenham in Suffolk proved unsuccessful. Recently a factory has been established at Cantley in Norfolk, and last year turned out 3,000 to 4,000 tons of granulated sugar. As there is no excise duty on sugar, the product enjoyed "protection" to the extent of £1 18 0 per ton. The balance sheet however shows, Mr. Scard states, a heavy loss and the farmers do not appear to have found the 23 shillings per ton paid for beets satisfactory, and have received a grant of £11,000 from the Development Commissioners presumably to compensate them for their losses.

Mr. Scard discusses in some detail the question of beet cultivation in England and on the Continent of Europe, and concludes thus:

"A good deal has to be learnt before the question of the advisability of establishing a beet sugar industry in Britain is decided, and at present it looks as if the cost, direct and indirect, of growing beets in this country is far too high. But there is one thing certain, and that is that a beet sugar industry cannot be carried on successfully without a protective tariff. The only country in the world in which there is an unprotected beet sugar industry is Holland, and advices before the war do not speak of the industry in that country as being in a flourishing condition.

"Beet sugar has now a very formidable competitor in cane sugar, and while the economic possibility of Great Britain being supplied with its own home-grown sugar is still a vexed question, there is no doubt that with a trifling fiscal assistance its Colonies could do all that is needful in this respect by supplying cane sugar. The cost of production of cane sugar is now universally recognised as being below that of beet. Java can produce 96° crystal for less than £3 per ton f.o.b.; the average Cuban cost of production for the same description of sugar is £8 10; Peru, with its exceptionally advantageous irrigation system and climate, is said to produce it for £8 10. The cost of production of German beet sugar is at least £9 per ton for a slightly lower polarising sugar. In fact, all the available evidence goes to show that given sufficient fiscal protection to compensate for transport disabilities as compared with continental beet, the whole of the sugar supplies of Great Britain could be obtained within the Empire. The output of the West Indies and Mauritius could be increased; the comparatively virgin soils of our East and West African possessions could be made to grow canes at a cheap rate, and a supply of highly desirable cane sugar thus secured for this country. The present crop of the West Indies is 220,000 tons or thereabouts; of Mauritius 240,000 tons. Fiji produces 100,000 tons, India requires, above her own production, 800,000 tons, Canada 300,000 tons, Great Britain 2,000,000 tons. Australia and South Africa consume their own production and also import sugar from outside. For the present wants of the British Empire therefore, over 2,500,000 tons of sugar are required over and above its present production. With a slight fiscal advantage given by this country this amount of sugar would be available in a very few years.

"It is thus seen that, to secure a sugar supply for this country, the establishment of a home sugar-industry is not essential. As mentioned above, it is universally recognised that beet sugar cannot be produced without protection. If protection is to be given, why should it not at least be equally devoted to the development of our Colonies, leaving our home farmers to continue to supply products which cannot be produced in the tropics? It is surely economically unsound to foster one industry which displaces or cripples another, when for the same consideration the industry can be established elsewhere under more favourable natural conditions."

SUGAR IN BRITISH INDIA.

The *Board of Trade Journal* for October 1, 1914, contains the following information from the *Review of the Trade of India 1913-14* which is of interest at the present time when attention is being given to the Empire's production of sugar:—

The production of white sugar in India has been a matter of serious study both by the Government of India and the local Governments, and as a result of the meeting of the Board of Agriculture, held at Pusa in 1911, progress has been made on the following lines.

A sugar engineer has been appointed and has been attached to the Agricultural Department in the United Provinces. He has set up a 100 ton factory at Pilibhit, which has had a satisfactory year working, and he has given technical advice regarding the erection of two central factories for the Gorakhpur district; he has also advised on several projects for the starting of similar schemes in other districts of the United Provinces. Farms have been opened at Nawabganj and Shahjahanpur in the United Provinces, and one in the Tirhoot Division of Bihar, for the introduction, survey, and testing of new canes. In Burma a sugar-cane experiment station has been opened in the area commanded by the Môn Canal. In the Kamrup district of Assam important work has been done in locating and surveying several blocks of 10,000 acres suitable for sugar-cane, and on a portion of this area a preliminary experiment is being undertaken by the local Government in the growth of cane with the aid of steam tackle with the object of encouraging enterprise on a large scale. A block of 4,682 acres of land in the Central Provinces has been leased to a Cawnpore gentleman with a view to the formation of a company, and a cane-breeding station for the production of new canes has been started in Coimbatore. The first year's work resulted in over 2,000 new seedling canes being selected.

In Bihar eight central factories have in recent years been erected with a crushing capacity of some 24,000 tons of cane a day. The erection of two or more factories is in contemplation. At Bubnowly, in the Gorakhpur District of the United Provinces, on the borders of Bihar, a central factory has been set up with a capacity of from 400 to 600 tons. The production of sugar in Bihar is paying and an extension of the industry is likely, conditions in this tract being favourable to the development of the central factory system. The sugar cane crop of India in 1918 gave a yield of nearly 2,600,000 tons, to which the production of palm sugar, estimated at 480,000 tons, should be added; the cane sugar crop comprises about a quarter of the world's cane crop of 9,500,000 tons.

Sugar Cane Experiments.—Mr. J. de Verteuil made the following report to the Board of Agriculture in October :—

In August I visited the Caroni and Brechin Castle Estates and selected fields for carrying out a series of manurial and varietal experiments on sugar canes as suggested in sections I and II of the Report of the Experiment Committee of May 22, 1914.* The canes for these experiments have already been planted. No favourable replies have been received from any of the other estate managers to whom circulars were forwarded inviting their co-operation, but at St. Augustine several varieties have been planted during this month on the lighter soils.

The sugar cane nursery at River Estate is being transferred to the experiment plot lands at St. Augustine as agreed to by the Sugar Committee and about two and a half acres have been planted, which will be extended later. 5,800 cane plants from the River Estate nursery have been supplied to four estates, and I have been informed by the managers that they were quite satisfied with the quality of the plants received.

The land formerly occupied by the sugar cane nursery at River Estate is being gradually converted into a field for the budded and grafted cacao experiments. The plots have been marked out and shade planted. Good pods from the selected trees are maturing and the seed from these will be planted within the next couple of weeks†.

* See *Bulletin XIII*, June 1914, p. 210.

† See also p. 320.

CACAO.

NATURAL YIELD OF INDIVIDUAL CACAO TREES.

Results at River Estate.

By P. CARMODY, F.I.C., F.C.S., Director of Agriculture.

On page 144, Vol. XI (1912) of this Bulletin a short article was published under the above heading. At that time results for two years only could be compared; we have now the results for four years.

The general conclusion arrived at in 1912 from a comparison of the results of two years has received further support from the results of 1913 and 1914. They are so very interesting and important to planters that the preliminary publication of even a small number is desirable. The "All Chupons" plot has been selected because no pruning is done on it, and the one hundred adjacent trees forming this plot have been taken for comparison. The results for any other hundred trees of the same age would be approximately the same, and would probably lead more or less towards the same conclusions.

The annual rainfall recorded on the estate for five years is as follows:—

	<i>Sep. 1 to Aug. 31.</i>	<i>May 1 to April 30.</i>
1909-10	88·20 inches.	78·57
1910-11	66·34 „	64·69
1911-12	54·27 „	55·72
1912-13	64·49 „	66·66
1913-14	55·79 „	62·86

The trees were from 25 to 30 years old in 1910 and are therefore at full bearing age. These two are the only varying factors, viz. a variable rainfall and increasing age.

The average annual yield for the four years is at the rate of 32 bags per 1,000 trees; 17 per cent. of the trees gave at the rate of over 50 bags, and nearly 60 per cent. at the rate of over 25 bags. The highest yield is from tree No. 2,008 which gave 79 lb. of dry cacao in the four years, an average of 237 pods per year, or at the rate of 118 bags per 1,000 trees. Tree No. 2,090 would probably have given a higher result, but it died in 1913. There can now scarcely be any doubt that the inherent productivity of individual trees as shown by these experiments is a factor of the greatest importance on an estate. In a future article the methods that are most likely to ensure high inherent productivity will be discussed. Similarly the question of the most profitable manures to use will be dealt with.

TABLE I.

PLOT D.D. ("ALL CHUPONS") AGE 25-30 YEARS IN 1910.

*Comparison of four years yields from individual trees.—
September 1 to August 31.*

No.	1911.	1912.	1913.	1914.	In 4 years.
	Pods.	Pods.	Pods.	Pods.	Pods.
2001	48	83	77	76	284
2	46	49	71	32	193
3	42	57	50	46	195
4	141	172	126	97	536
5	54	113	86	64	317
6	72	97	94	67	330
7	36	77	69	75	257
8	167	267	286	227	947
9	124	158	139	176	597
10	102	167	121	121	511
11	89	113	145	30	377
12	123	205	169	188	685
13	52	86	38	55	231
14	34	68	43	74	219
15	7	1	2	3	13
16	106	79	78	79	342
17	8	3	16	11	38
18	34	85	56	55	230
19	51	85	67	38	241
20	61	80	79	90	310
21	45	70	7	6	128
22	113	49	35	90	287
23	26	20	28	35	109
24	64	39	56	50	209
25	9	28	27	48	112
26	118	124	132	125	499
27	39	77	44	49	209
28	39	60	62	70	231
29	11	30	17	43	101
30	52	34	6	2	94
31	11	20	29	35	95
32	11	4	21	44	80
33	104	57	135	110	406
34	55	50	22	55	182
35	43	101	67	65	276
36	27	49	56	23	155
37	86	142	182	171	581
38	184	100	94	92	420
39	42	88	12	28	120
40	23	34	12	17	86
41	27	30	51	25	133
42	80	187	107	101	475
43	61	81	88	29	259
44	181	242	111	154	638
45	3	7	15	13	38
46	92	159	77	163	491
47	62	71	82	101	316
48	70	90	78	109	342

TABLE I.—CONTINUED.

No.	1911.	1912.	1913.	1914.	In 4 years.
	pod.	pod.	pod.	pod.	pod.
2049	186	140	203	140	619
50	85	56	93	82	316
51	97	87	37	181	352
52	71	61	86	95	313
53	5	13	15	6	39
54	17	19	17	31	84
55	38	58	75	56	227
56	14	69	89	67	232
57	28	74	84	46	182
58	13	40	57	62	172
59	11	22	16	59	108
60	20	62	59	69	210
61	38	50	41	42	171
62	35	52	4	47	138
63	50	30	71	33	184
64	51	101	64	98	314
65	25	55	39	39	158
66	176	206	170	68	620
67	15	45	32	57	149
68	65	35	48	49	197
69	73	78	74	111	336
70	8	2	1	4	15
71	49	88	45	65	197
72	16	12	19	17	64
73	58	43	105	68	279
74	83	112	94	63	352
75	26	24	33	48	131
76	21	24	28	21	94
77	46	65	53	73	237
78	19	29	28	25	101
79	13	41	16	24	94
80	84	152	74	58	368
81	93	57	95	80	325
82	28	30	20	11	89
83	10	31	84	67	142
84	34	84	124	78	320
85	23	55	48	34	160
86	32	70	30	37	169
87	127	113	90	81	411
88	64	78	57	69	268
89	22	11	29	30	92
90	269	290	dead	...	...
91	76	100	89	46	311
92	113	96	157	202	568
93	20	38	33	28	119
94	38	6	9	38	91
95	54	68	58	51	231
96	30	65	37	44	176
97	121	136	123	134	514
98	18	34	53	69	174
99	56	33	65	78	227
2100	47	66	75	55	243
Total for 99 trees ...					25,690

NATURAL YIELD FROM 100 TREES. (SUMMARY.)

The following summary of the results recorded in Table I shows a remarkably steady percentage during the four years:—

Pods per tree.	1911.	1912.	1913.	1914.
Over 100 ...	17 ...	21 ...	19 ...	17
50 to 100 ...	32 ...	39 ...	37 ...	41
25 to 50 ...	26 ...	25 ...	23 ...	28
Under 25 ...	25 ...	15 ...	21 ...	14

Highest yield (Tree No. 2,008) 947 pods—79 lb. dry cacao in 4 years.

Lowest yields (Tree No. 2,015) 18 pods—1 lb. dry cacao in 4 years.

(Tree No. 2,070) 15 pods—1½ „ „ in 4 years.

MANURIAL EXPERIMENTS.

In the first manurial experiment plots (Field I) we have now obtained the total yield for four years, including individual yields for three years. These results are arranged (Table II) so as to show the yield in pounds of dry cacao and in this form are equally instructive. There were in 1910 approximately 50 trees in each plot, and the experiments were begun before the importance of the natural yield from each plot was realised. The trees were about twelve years old in 1910, and an appreciable allowance should be made in this case for increased productivity due to increasing age. Any further increase may be due to the manures used, but of this we cannot yet be certain. The danger of placing reliance on control plots is here clearly exemplified. In 1911–12 Control (A) had 65 per cent. of its trees yielding 2 lb. cacao and under, Control (G) had 46 per cent., and Control (U) had 43 per cent. Control (G) contained one tree giving in 1911–12, 13 lb. of dry cacao equal to thirteen trees in the 1 lb. column. Plot (U) is the most uniform of the three control plots.

In the results it will be noticed that from year to year there is a marked reduction in most cases in the percentage of trees yielding 2 lb. of cacao and under, and a marked addition to heavier yields. In 1911–12 the heaviest yield was 14 lb. from an individual tree: in subsequent years there are four trees at 15 lb., six at 16 lb., one at 17 lb., one at 19 lb., and one at 21 lb. dry cacao.

The lined plots (L.) and (W.) have shown that lime alone is of no value as a manure for our cacao soils. This was anticipated, and the experiment was made for the purpose of showing the inefficiency of lime alone. Most of our soils are deficient in lime, and the addition of lime would be a great benefit to them but other plant food must be provided at the same time.

The order occupied by each plot amongst the best ten plots in each year is shown in the last column but one. Q with pen manure and a small addition of artificial manures has given the highest yield in each of the four years (indicated by the numbers 1, 1, 1, 1.) E with twice as much pen manure and no artificials has risen from 5 and 6 to 2 and 2; R with artificial manures only has maintained a steady and improving position; V, a plot with bird manure has lost ground from 2 and 2 positions to 7 and 9.

The columns "Pounds of dry cacao" are calculated at the rate of 12 pods to the lb., and are to be read as follows:—

1 = 1 lb. and under; 2 = 2 lb. and over 1; 21 = 21 lb. and over 20. and so on for each column.

Trees yielding not more than 2 lb. of dry cacao are not profitable enough to justify much expenditure on the cultivation; and as these experiments have shown that much higher yields are obtainable, with or without manures, our efforts should mainly be directed towards a reduction in the percentage of these low yielding trees.

F.	{	1910-11	49	16	8	9	3	3	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1</
----	---	---------	----	----	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	-----

TABLE II.—Continued.

River Estate—Plots under Manurial Experiments, Field 1.—CONTINUED.

Plot.	Years.	No. of trees.	POUNDS OF DRY CACAO.																			Total yield in pods.	Per cent. of trees yielding 12 lb. cacao and under.	Order in the best 10 plots in each year.	Manures applied each year.			
			1 and under.		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18					19	20	
M.	1910-11	50																							1,468	{ 100 lb. Basic slag. 25 lb. Sulphate of Potash. Half mulch. Half mulch repeated.
	1911-12	50	19	13	12	1	1	1	3																64	...	...
	1912-13	49	11	12	13	7	4	2																	47	...	...
	1913-14	49	8	5	8	6	10	4	4	2	2														26	...	...
N.	1910-11	49																								{ 50 lb. Basic slag. Mulch. Mulch. 13 lb. Sulphate of Potash. 13 lb. Sulphate of Ammonia.
	1911-12	48	21	10	9	5		1	2																64	...	...
	1912-13	48	20	7	8	7	4		2																56	...	...
	1913-14	48	14	5	11	3	7		4	2				1											40	...	...
O.	1910-11	51																								{ Full mulch. Full mulch repeated.
	1911-12	51	14	21	9	3	2	2																	68	...	...
	1912-13	50	7	13	13	9	2	4	1	1															40	...	...
	1913-14	50	6	13	10	6	3	4	3	1															38	...	...
P.	1910-11	52																								...	7	{ 12 Loads Pen Manure. 100 lb. Bone meal. 13 lb. Sulphate of Potash. 13 lb. Sulphate of Ammonia.
	1911-12	52	11	14	9	5	3	2	4	3	1														48	...	...
	1912-13	52	7	10	8	8	7	5	3	1	3														32	...	...
	1913-14	52	3	7	11	5	7	6	1	2	2			1	1										19	...	...
Q.	1910-11	49																								...	1	{ 12 Loads Pen Manure. 25 lb. Sulphate of Potash. 13 lb. Sulphate of Ammonia.
	1911-12	48	5	8	8	3	4	4	2	4	1														27	...	...
	1912-13	46	3	3	7	9	6	8		1	5	3	1												13	...	...
	1913-14	46	2	2	3	7	6	5	7	5	2	4		1	1	1									9	...	...

[illegible]

EXPERIMENTS WITH BUDDED AND GRAFTED CACAO.

Success having been achieved in budding cacao, as has already been reported in this *Bulletin*, it is necessary to carry on the work on a commercial scale in order to ascertain whether budded trees will actually be of advantage on cacao estates. The mere fact that budding has been accomplished is of interest, but will be of no practical benefit to the planter if after a few years the only tangible results are a few budded trees in Botanic Gardens. The planter wants to see a fair sized area in budded plants under normal estate cultivation because it is only in this way that he can form a definite opinion as to the value of such trees in comparison with ordinary seedlings grown under similar conditions.

Amongst the data which must be available in order for him to arrive at a sound conclusion are the following:—

1. The practicability and the cost of preparing budded plants.
2. The season at which to bud, and whether budding is best done on plants grown in the nursery or raised at stake in the field.
3. The habit of budded trees; whether they develop into low bushy plants or normal shaped trees.
4. The best planting distance compared with ordinary trees under similar conditions.
5. The power of resistance to drought, disease, etc., of budded trees.
6. The age at which they come into bearing.
7. The degree to which budded trees retain the characteristics of the parent tree, *e.g.*, bearing capacity, kind of cacao, etc.
8. The yield of budded trees compared with ordinary seedlings.

With reliable information on these points it should be possible to obtain a correct answer to the vital question: Does it pay to form an estate of budded cacao in preference to the usual method?

At the present moment this question cannot be satisfactorily answered. It is known that in some other cultivations in temperate regions budding or grafting (the two processes are identical in principle) is advantageous, and hence we can express the opinion that budding may be advantageous with cacao also. But this is not an answer to the question; it is an expression of opinion which may or may not be justified by results when the trial is made.

The work already accomplished at St. Clair shows that it is practicable to bud cacao readily under ordinary nursery conditions. Bud wood from selected trees is obtained at River Estate where the pod records are kept of some 10,000 trees. It is gathered in the morning, brought to St. Clair—about seven miles—and budding proceeded with the same afternoon. If the work is not completed that day, the bud wood is covered up with earth, when it remains in perfectly good condition for work on the next day. The whole operation is performed in the nursery, where the plants remain, demanding only ordinary nursery treatment, until thoroughly established. This is a great improvement on the procedure entailed in grafting by approach, when bamboo supports to hold the stocks have to be set up around the selected trees in the field, and as these are often a considerable distance apart the necessary attention and watering during six weeks or two months are both troublesome and expensive.

In order to test the comparative merits on an estate scale of seedling, budded and grafted trees an experiment is being started at River Estate on lines approved by the Experiment Committee of the Board of Agriculture. (*See Bulletin*, xiii, 1914, p. 211.)

Ordinary shade.	A.	1 acre cacao budded at stake.
	B.	1 acre cacao budded in nursery.
	C.	1 acre cacao seedlings.
	D.	1 acre cacao grafted.
No permanent shade.	E.	1 acre cacao budded at stake.
	F.	1 acre cacao seedlings.

The planting distance throughout will be 12 feet by 12 feet.

In order to make the results a real test of the value of budded or grafted plants as compared with seedlings it is necessary that the buds and grafts should be taken from the same trees as those which supply the seeds. Accordingly the following trees have been selected on account of their bearing capacity over a period of four years, and the character of their cacao, *i.e.*, they are all good type Forastero plants with an average annual yield of at least about 100 pods per annum.

A corresponding set has been selected for the Calabacillo stocks. Particulars regarding both are given in the following table:—

SELECTED "FORASTERO" TREES.			SELECTED "FORASTERO" TREES.		
No.	No. on tree on Estate.	Number of pods picked, 4 years average 1910-11—1913-14	No.	No. on tree on Estate.	Number of pods picked, 4 years average 1910-11—1913-14
1	79	140	24	2225	124
2	407	114	25	2314	114
3	556	120	26	2359	162
4	559	106	27	2394	105
5	969	111	28	2453	111
6	1097	165	29	2462	143
7	1114	114	SELECTED "CALABACILLO" TREES.		
8	1139	174	31	2	117
9	1158	95	32	198	107
10	1229	164	33	199	116
11	1278	174	34	232	119
12	1285	134	35	337	176
13	1304	127	36	1281	123
14	1333	111	37	1290	105
15	1386	237	38	1347	110
16	1402	145	39	1416	78
17	1430	120	40	1464	141
18	1448	105	41	2107	143
19	1454	92	42	2170	112
20	1480	185	43	2271	129
21	2038	105	44	2298	181
22	2119	158	45	2408	181
23	2190	194			

In the two seedling plots, C. and F., 10 pickets will be planted, with three seeds each, from each of the selected Forastero trees Nos. 1-29. Plot C. will have ordinary permanent shade whilst plot F. will not. The results from these plots will show to what degree seedlings retain the character and heavy bearing power of their parents.

In the plots of budded or grafted trees the stocks will be raised from seed of the selected Calabacillo trees, 20 pickets being planted with seed of each of the 15 trees in plots A. and E., and a corresponding number of seedlings raised in the nursery for plots B and D.

Next year the stock plants so raised will be budded or grafted from the same Forastero trees which supplied the seed for the seedling plots, and in the same proportion. That is to say whilst plot C. will have 10 plants raised from seed of tree No. 1, plots A., B. and E. will each have 10 budded plants from tree No. 1 and plot D. 10 grafted plants from the same tree; and so on for the remaining selected Forasteros Nos. 2-29. In this way, if all goes well, reliable answers should be obtained to the questions the experiment is designed to solve. There will be seedling, budded and grafted plants, all of exactly the same age, and all derived from exactly the same known trees. They will be grown under similar conditions, and should it prove to be the case that budded or grafted plants come into bearing sooner than seedlings, and retain better the good qualities of their parents an important point will have been established. But the experiment should decide more than this, which could be determined with a few trees. It is for this reason that it is being conducted on a large scale, so that it may give the information which, as noted above, the planter requires in order to decide whether the ordinary method of planting from seed should give place to the use of budded or grafted plants. The deciding factor in this is the pecuniary result.

W .G. FREEMAN.

Imports of Cacao, etc., into France.—Information has been received from Messrs. C. M. and C. Woodhouse, London, that the Foreign Office has announced that the product of British Colonies, imported into France, will be exempted from payment of the *Surtaxe d'entrepôt*.

The exemption will be conditional on the production of original bill of lading and of a certificate of supervision from the British Customs; in case such supervision has been interrupted and the goods have been warehoused, the certificate must take the form of a guarantee that the goods have remained properly sealed.

PLANT DISEASES AND PESTS.

MYCOLOGICAL NOTES.

WITCH BROOM DISEASE OF CACAO.

The following report made by Mr. J. B. Rorer, Mycologist, to the October meeting of the Board of Agriculture is of especial interest as indicating the advance made in the knowledge of the cause of the witch broom disease which has done such great damage in the cacao plantations of Surinam. Mr. Rorer said:—

The following resumé of an article which appeared in the Surinam paper *De West* of October 9, may be of interest to you. You may remember that under your auspices I made two trips to Surinam to study the Witch broom disease of cacao. The results of this work were published in Circular No. 10 of the Board. The conclusions which I reached both in regard to the causative fungus and means of control were quite different from those of Van Hall and Drost, whose elaborate paper on the disease was translated by Dr. Fredholm for the *Proceedings of the Agricultural Society, Trinidad and Tobago*.

“ Dr. Stahel who has recently been appointed Mycologist [to the Agricultural Department of Surinam] has taken up the study of the witch broom disease since Rorer, Mycologist of the Board of Agriculture, Trinidad, raised the question as to the soundness of the work of Van Hall and Drost. Dr. Stahel during the past two months has made 175 cultures from the inner tissues of witch broom and hardened pods, and in almost every case (165 out of 175) he obtained pure cultures of a fungus belonging to the Basidiomycetes, thus agreeing with the work reported by Rorer. In the past few weeks he has found a basidiomycetous fungus fruiting on the dead witch brooms and by using this he has been able to produce witch brooms by inoculation. The fungus *Colletotrichum luxificum* to which Van Hall and Drost attributed the disease, is merely a saprophyte (that is a fungus which lives on dead tissues, as opposed to a parasite which lives on living tissues).

“ The recommendation of Rorer in regards to spraying as a better means of control than the cutting back, the method of Van Hall and Drost, already borne fruit and is being put into practice on several large estates.”

At the November meeting of the Board Mr. Rorer exhibited fruiting specimens of the fungus which had been forwarded to him, in the preserved state, from Surinam.

On the conclusion of Mr. Rorer's report Mr. Freeman said that he was sure the whole Board would unite in congratulating Mr. Rorer on the successful issue of the work he had started in connection with Witch broom disease.

ENTOMOLOGICAL NOTES.

CACAO BEETLES AND THRIPS.

At the October meeting of the Board of Agriculture Mr. F. W. Urich, the Entomologist, reported that since the last meeting a visit was paid to the district of Erin where cacao beetles still continue to be in evidence, and in some places have been quite injurious. On many estates control work is undertaken but it is not done everywhere as it should be, and there is not enough co-operation. No thrips were noticed in the Erin district, but at Sangre Grande there are a few to be seen in patches: not in sufficient numbers to be injurious up to now, but if the weather should become dry, they may increase. A careful watch should be kept so as to apply remedial measures as soon as any spread is noticed.

At the November meeting Mr. Urich said:—

“Since the last meeting of the Board I visited the Toco district together with Mr. Rorer. As far as insect pests of cacao are concerned, the conditions are very favourable. The cacao beetle (*Steirastoma depressum*) and thrips were present, but not in any number, and in isolated spots that were in exposed positions, either wanting in shade or wind swept. In view of these facts I would strongly recommend to the planters of the district to pay attention to the beetles so as to prevent them spreading as much as possible. In the Sangre Grande district the thrips were much in the same way as reported at the last meeting, with a tendency to increase. Should dry weather set in, it would be advisable to spray the patches affected.”

FROGHOPPERS.

At the October meeting of the Board of Agriculture Mr. Urich stated that in connection with froghoppers, there are not as many as last year, and on the two estates visited since the last meeting, there is no pronounced froghopper damage visible. A few fields appear to be affected, more by unfavourable weather than by froghoppers.

LIVE STOCK.

NODULAR DISEASE OF THE STOMACH IN SHEEP.

DEATH OF ROMNEY MARSH EWE.

In October Mr. Meaden, Manager of the Government Farm, Tobago, reported the death of a Romney Marsh ewe.

The ewe was put up as usual in the evening and found dead the next morning. There was no trace or outward sign of the cause of death and a *post mortem* examination showed the organs to be in a healthy condition. On further investigation Mr. Meaden found the cæcum and the parts of the bowel posterior to it studded with numerous nodules, caused, he was of opinion, by the parasite *Oesophagostoma Columbianum* (Curtice).

Material was forwarded to Dr. C. F. Lassalle, the acting Government Bacteriologist for examination and he reported as follows:—

I have carefully examined specimens of sheep's bowel sent from Tobago by Mr. Meaden.

Result of Examination.—Naked eye examination showed a very large number of nodules varying in size from a pin's head to a large pea. Some of the nodules were very hard to the touch, having almost a calcareous consistence. On section of the nodules, each was found to consist of a thin walled sac containing caseous material which was practically dry. Microscopical examination showed the contents to be amorphous debris, with very few exceedingly slender embryos, thickened at one end but showing no distinct parts. There was no appearance of giant cells or of tubercle bacilli either in the contents or the walls of the nodules, and there was no sign of ulceration or pus anywhere. The contents of the gut were examined for mature worms, but none were found.

Remarks.—At page 233 of Friedberger and Frohner's *Veterinary Pathology* there appears the following: "*Oesophagostoma Columbianum*" causes the so-called nodular disease of the stomach in sheep and cattle, (Japan and Arkansas). The larvæ which are 1.25 inch in length, live in the intestinal wall, where they form nodules, in size a millet grain to a pea.

At page 485 of the United States Department of Agriculture *Diseases of Cattle* it is stated that Nodular disease is caused by a small worm *Oesophagostoma Columbianum* which burrows into the wall of the intestine, and around which the nodules form. The life history is said to be similar to that of the twisted strongyle.

It may be of interest to mention the fact that in the human subject there has been described a similar worm, the *Oesophagostoma Bumpti* in a cyst in the intestine of an African negro, as well as in a native of Brazil.

Opinion.—I am of opinion that Mr. Meaden's diagnosis is correct and that (having excluded tuberculosis) the disease of which the sheep died could not have been caused by anything but the *Oesophagostoma Columbianum*, the known cause of Nodular disease in sheep and cattle.

I shall be very glad to receive specimens of the same or similar disease from the Government Farm of Trinidad or Tobago for further inquiry.

Mr. J. Duncan Millar, the Government Veterinary Surgeon, in commenting on the above report says:—

The sheep was evidently affected with one of the forms of the nematode parasites, viz, the *Oesophagostoma Columbianum* and died from the effects of same.

I recommend :

- (a.) That pen and pasture be dressed with temper lime and salt.
- (b.) That the animals have rock salt put in places for them to lick.
- (c.) That drinking ponds be treated with sulphate of copper solution.

The nematode parasites in various forms are present all over the Colony of Trinidad and Tobago, and an outbreak should be dealt with as recommended.

MAL DE CADERAS.

An account was given in this Bulletin, page 28, (January 1914) of the fatal disease known as *Mal de Caderas* which was affecting horses and mules in British Guiana. The disease was due to a parasite in the blood, a trypanosome, a class of organisms which are the cause of sleeping sickness in man, and various horse and cattle diseases in Africa and elsewhere. These diseases are commonly spread by flies, and it was considered possible in British Guiana that in this case the common house fly was the worst offender.

No case of the disease occurred in Trinidad or Tobago and it is pleasing to be able to record that the Government has been officially informed that British Guiana "is now [October 24, 1914] reported to be free from cases of *Mal de Caderas* amongst its horses, mules and asses. The last mules suspected to have the disease in a chronic form were destroyed on September 8."

FRUIT.

NOTES ON EXPERIMENTAL DRYING OF BANANAS.

The following notes relate to an experiment which Mr. Brunton was asked to carry out in drying Gros Michel bananas. The resulting dried fruit were of good appearance and very palatable as they were or after subsequent cooking :—

The figs for this experiment were not all equally full or mature and in consequence ripened very irregularly, the most mature ripening in three to four days whilst the least mature took eleven days.

The first lot was put out to dry on September 13, drying being completed by the 21st, a period of nine days ; there was, however, very little sun on the first day as it rained almost continuously, and only a half day's sun on the 17th.

The remainder were put out in two lots on September 18 and 19 respectively, and were ready for packing by the 25th, two days during this period were rainy with very little sun, it is therefore evident that in favourable weather drying can be accomplished in from five to six days.

The procedure adopted was as follows : when the bunches were brought in from the field they were divided in hands, packed in a heap in the store-room on a bedding of banana leaves and covered with dry grass.

When ripe the figs were separated from the hands and peeled, care being taken to remove the "strings" below the thick skin ; they were then placed in rows on the drying floor of the cacao house, exposed to the sun and turned continually during the day, at night they were heaped up and covered with dry banana leaves, but this was only done to the last lot from the third to the sixth day ; it appears to assist the drying.

If a sufficient quantity of bananas were treated the cost should not, I think, exceed two to three shillings a hundred.

L. A. BRUNTON,
Agricultural Inspector.

Budding Avocados.—This work is being successfully proceeded with at St. Clair Experiment Station by the method of patch budding. Plants have been prepared of good local varieties and also of the "Trapp" avocado which is regarded as one of the best kinds for export purposes.

BOTANICAL.

CAMOENSIA MAXIMA.

Camoensia maxima is a beautiful plant very rarely met with in private gardens. It is, however, well worthy of a place, having deep green glossy leaves which look well throughout the year, whilst in addition it bears some three or four times during the year, trusses of large white flowers. The plant can be cultivated as a climber, but it is not of very rampant growth and is very effective if allowed to form an irregular shrubby mass, or a hedge, supported on a fence or any similar structure.

In this Colony in particular *Camoensia* should meet with appreciation as it was in the Trinidad Botanic Gardens that the plant first flowered under cultivation, as shown by the following extract from the *Kew Bulletin* 1894, p. 402, which also gives a good description of the flower:—

"Through the courtesy of Mr. William Bull we have seen a flower of this gorgeous climber from the first inflorescence, we believe, produced in Europe. *Camoensia maxima* was one of the numerous important discoveries made by the late Dr. Welwitsch during a long residence in Angola. It is a member of the *Leguminosæ*, and was first described and figured in 1865, in the *Transactions of the Linnean Society* (Vol. XX, p. 801, plate 36.) The flowers of Welwitsch's original specimens, represented in the plate cited, were just about a foot long, and the largest in the natural order. These specimens are collected at Golungo Alto, a little north of the River Cuanza. Subsequently Mr. and Mrs. Monteiro sent specimens to Kew from Quiballa, a place situated about sixty miles inland from Ambriz; and Mr. H. H. Johnston from the Congo, below Stanley Pool. Both of these specimens have shorter flowers, as well as the cultivated plant; but the beauty of the flower resides in the broad frilled petals. Mr. W. Mackie, gardener to Mrs. Ruddle, The Mythe Castle, Tewkesbury, is the successful cultivator of the *Camoensia*; and he writes that the edges of the white petals are at first of a bright golden yellow, changing to old gold on the full expansion of the flowers. The plant in question produced only one raceme of four flowers, Mr. Montiero, who figured and described the *Camoensia* (*Angola and the River Congo*, Vol. 1, p. 177), sent seeds to Kew from the locality mentioned above in 1878; and a number of plants were raised and distributed to the principal botanic gardens and nurseries. It first flowered in the Trinidad Botanic Garden in 1882, then under the superintendence of Mr. Henry Prestoe; and early in the present year Dr. Trimen recorded (*Gardeners' Chronicle* 3rd series, XV, p. 286) its flowering in the Ceylon Botanic Garden. Mr. W. Bull offered it for sale in 1885. We have not succeeded in flowering it at Kew yet, though we have now had it growing for twenty-two years."

Originally regarded as having the largest flower of any plant of the *Leguminosæ* it now has to yield place as regards size to *Baikiaea insignis*, a Tropical African tree with flowers ten inches across. This tree has flowered for some years at Dominica, but is not as yet one of the ornaments of our gardens.

Camoensia although flowering freely sets but few seeds and some of the plants so obtained have not proved very robust. This season special attention has been given to propagation by layering, with more success than was the case during the last two years, perhaps due to the wetter season, and some thirty plants are now available for sale at 50 cents each.

The flowers of *Camoensia* open in the late afternoon; then and during the evening they are deliciously scented like several others of the white flowers which are open during the night. During the next day they rapidly fade and turn dark. Attention has recently been directed to this plant by Professor C. F. Baker in an article entitled "Dissemination of New Tropical Plants" *American Breeders' Magazine* IV, pp. 209—17. He gives a figure of a flowering branch and describes the plant as a wonderful climber which should be widely spread throughout the tropics.

W. G. F.

NURSERY WORK.

Plants sold and Distributed from St. Clair Experiment Station.

APRIL 1 TO SEPTEMBER 30, 1914.

				Sold.	Distributed in exchange or Gratis.
Cacao Seedlings	...	...	...	24,591	14
" Budded	...	...	...	153	4
" Grafted	...	...	...	150	5
Coffee Robusta	...	...	...	7,490	50
" Other Varieties	...	...	...	4,252	..
Citrus Budded	...	...	...	189	...
" Seedling	...	...	...	222	8
Decorative Flowering	...	...	...	588	70
" Foliage	..	...	...	277	91
Ferns	...	...	...	104	6
Limes	...	...	...	8,540	...
Mango Grafted	...	...	...	423	24
Miscellaneous Fruits	...	...	...	1,329	210
Miscellaneous	...	...	...	1,678	205
Orchids	...	...	...	...	665
Palms	...	...	...	775	78
Rubber	...	...	...	216	1
Spices	...	...	...	181	88
Shade	...	...	...	979	524*
Timber	...	...	...	645	2
				52,882	2,045

* 500 *Gliricidia* cuttings.

Seeds.

			Sold.	Distributed.
Coffee Robusta	...	...	56 lb.	...
" Other Varieties	...	...	16½ "	...
Countable Seeds	...	...	19,218	7,604
Packets	...	...	48	120
Pods	...	...	6	...

Revenue from Plant Sales.

Year.	Trinidad.	Tobago.
	£ s. d.	£ s. d.
1908-09	396 16 5	88 9 8½
1909-10	394 5 3½	42 1 3
1910-11	212 10 0½	26 12 6½
1911-12	250 3 2	29 19 10½
1912-13	197 12 2	28 0 4
1913-14	450 4 11½	28 12 2
Six months—(April to September 1914)	458 8 10	48 9 3½
April to September, 1913...	£ 259 7 4	£ 15 16 3½

The above returns indicate the extension of the nursery work which has taken place during the last few years. The receipts for 1914 have already in six months exceeded the total for the previous year (1913-14) which was considerably more than twice the total for 1912-13.

Another feature of interest is that sales of budded and grafted cacao for the first time demand separate record in the list. It may well be that in time seedling cacao will be relegated to the subordinate position.

W. G. F.

WEST INDIAN BOTANIC GARDENS.

The following note appears in *The India Rubber World* of August 1, 1914.

"In America the botanical establishments are scattered from Canada to the Falkland Islands. There are twelve in the West Indies, or fourteen if Trinidad and Tobago be so classed. That of Jamaica has been in existence since 1779.*

"A number of the botanic gardens in the West Indies and Guianas have been described in considerable detail and illustrated by photographs in the accounts contributed to *The India Rubber World* by its editor or

* *The St. Vincent garden dates from 1765. (Ed.)*

published by him in his book on the tropics. All of these botanic gardens, with the experiment station usually conducted in conjunction with them, are under the management of the botanical experts sent out from England, who as a rule are not only men of scientific attainments, but good organisers and well equipped for their varied executive duties. They take a profound interest in their occupation and work with the greatest diligence year after year to achieve substantial results.

"In Jamaica there are two notable gardens and an experiment station. They have devoted much attention to rubber producing trees, The *Heveas*, *Castilloas*, *Sapiums* and their own rubber vine, *Forsteronia*. There is an interesting garden in Antigua, where a great variety of rubber trees has been tried in an experimental way, the *Manihots* especially having been carefully studied.

"In Trinidad there is a wonderful garden and a splendid experiment station. Here are also the oldest and best specimens of *Hevea*, *Castilloa* and *Funtumia* in the West Indies. Tobago which is really a part of Trinidad, has done much with *Castilloas*. In British Guiana, at Georgetown, there is a notable botanical garden, and many experiments have been tried in the planting of *Hevea*, *Castilloa* and *Sapium*."

MULBERRY FOR SILK WORMS.

The possibility of developing a Silk Worm industry in the West Indies has naturally directed attention to the available food-plants. The true silk-worm feeds on mulberry of which however there are several varieties. For many years plants of a mulberry have been cultivated at St. Clair and are readily propagated both by cuttings and by seed.

Specimens sent to Kew have been determined there as *Morus alba* Linn. var. *latifolia*, Burr. which Mr. Hill, the Assistant Director adds "is one of the best forms for feeding silk-worms."

Anyone who should think of embarking experimentally on silk-worm rearing will thus be able to obtain locally supplies of the food plant with the knowledge that it has already been proved to thrive in the Colony.

THE IMPERIAL INSTITUTE.

ARRANGEMENTS FOR UNDERTAKING PRIVATE INVESTIGATIONS.

As indicated in the following despatch to His Excellency the Governor from the Right Honourable the Secretary of State for the Colonies the Imperial Institute is now prepared to investigate and report on raw materials, etc. submitted by private persons. In the past such investigations have usually only been undertaken on behalf of the various Governments throughout the Empire:—

DOWNING STREET,

September 11, 1914.

SIR,

I have the honour to inform you that my attention has been directed to the yearly increasing demands which are being made on the Imperial Institute by private individuals and firms for reports on technical subjects and especially on the composition and value of raw materials.

2. In the past it has generally been impossible to accede to such requests for investigations from private individuals and firms owing to the pressure of other work. At the same time the conduct of such investigations seems to me to be a legitimate function of the Institute, and I have been given to understand that the demand for such reports would be considerably extended if it were known throughout His Majesty's possessions that the Institute was prepared to undertake for individuals special reports of the kind indicated in paragraph 8 of the Earl of Elgin's Circular despatch of July 31, 1906.

3. The Institute, however, is now so completely occupied with the scientific, technical, and commercial researches demanded by the Agricultural, Mines, and other technical departments of the Governments of those parts of His Majesty's dominions which contribute to its funds that it is impossible to undertake investigations on any considerable scale for private individuals and firms without adding to the technical staff, and therefore, to the general expenses, of the Institute. But, having decided to meet what I believe to be a growing demand for such work I am authorising the Imperial Institute to undertake in future, for an appropriate fee, researches, investigations, analyses, etc., required by private individuals and firms, either in this country or any of His Majesty's oversea dominions.

4. It will be left to the authorities of the Institute to decide in the case of each application whether or no the request for researches, etc., is one with which the Imperial Institute can properly comply.

5. Any reports which may be supplied under this arrangement will become the property of those who pay for them and will not be communicated either by the Imperial Institute or by any Government to other persons, or published without the consent of those concerned.

6. As it is undesirable that the Imperial Institute should compete with the professional expert, I propose that only special investigations, etc., should be undertaken, *i.e.*, on subjects of a technical character with which the Imperial Institute is exceptionally qualified to deal, especially those relating to the production and utilisation of materials which occur

in the British Empire or which might be introduced into British countries and are considered likely to be of value to British commerce or trade.

7. It may be useful if I refer to some of the more important matters with which the Imperial Institute is in a special position to deal:—

- (a.) Investigations as to the value of new or little known raw materials for commercial purposes.
- (b.) Chemical analyses, assays and valuations of raw materials, such as fibres, rubbers, oil-seeds, waxes, food-stuffs, tanning materials, essential and fixed oils, gums, resins, drugs, tobaccos, soils, minerals, ores, waters, fuels, etc.
- (c.) The technical testing of rubber, timbers, cotton fibres, cements and other materials.
- (d.) Identifications of vegetable and mineral substances.

8. I am informed that the Managing Committee are not prepared at present to suggest any actual scale of fees which could meet the variety of cases which are likely to occur. The fee must be arranged between the Institute and the individuals or firms who require investigations to be made. The matter will be in the hands of the Director, who will from time to time report to the Managing Committee the fee proposed in any special case in which this cannot be determined by ordinary practice.

9. I believe that the adoption of the plan I have indicated will increase the usefulness of the Imperial Institute to the manufacturing and industrial communities of all countries of the Empire; and, as it will doubtless be of importance to the residents of the Colony under your government, I shall be glad if you will take steps to make the arrangement I have sanctioned widely known, either by publishing this despatch in whole or part in the Official Gazette or in such other way as may seem to you to be most effective.

I have the honour to be,

Sir,

Your most obedient humble Servant,

The Officer Administering
the Government of Trinidad and Tobago.

(Sgd.) L. HARCOURT.

BOARD OF AGRICULTURE.

AGRICULTURAL TAX 1915.

The Board of Agriculture appointed the usual Special Committee to assess the rates at which the taxes to provide the funds for the Board should be levied on the chief Agricultural exports during 1915. The report of the Committee, which was adopted at the meeting of November 20, recommends, the following rates: Cacao $1\frac{1}{2}$ cents per 100 lb. (the same as in 1914) Sugar $8\frac{1}{2}$ cents per 1,000 lb. (4 cents in 1914), Coconuts $2\frac{1}{2}$ cents per 1,000 (8 cents in 1914) and Copra 5 cents per 1,000 lb. (6 cents in 1914.)

The expenditure of the Board in 1915 is estimated at \$18,488, and as there will be a balance of about about \$8,000 at the end of 1914 the tax has been designed to provide about \$10,000. The report is as follows:—

The Committee appointed by the Board of Agriculture to consider the rates to be levied for the year 1915 under the Agricultural Tax Ordinance to raise the sum of \$10,000, recommends the following, viz.:—

Sugar,	on every 1,000 lb.	$8\frac{1}{2}$ cents.
Cacao,	" " 100 "	$1\frac{1}{2}$ "
Coconuts,	" " 1,000 "	$2\frac{1}{2}$ "
Copra,	" " 1,000 lb.	5 "

The same method of assessment has been adopted as has been followed since the Taxes were introduced, viz:—that of charging each product in proportion to the average values exported during the preceding 3 years, the coming crop being estimated on a similar average.

Detailed figures are attached.

(Sgd.) G. TOWNSEND FENWICK,

Port-of-Spain,

Chairman.

November 19, 1914.

MEMO FOR AGRICULTURAL TAXES, 1915.

CROPS EXPORTED.

Year.	Sugar.	Molasses.	Rum.	Cacao.	Coconuts.	Copra.
	lb.			lb.	nuts.	lb.
1911	84,978,544	...	...	49,790,882	20,602,928	1,662,114
1912	74,290,188	...	...	41,625,625	16,805,088	2,860,210
1913	78,146,928	...	...	48,116,877	16,890,897	1,145,589
Total	232,415,610	...	...	139,532,884	58,551,293	5,677,863
3 years average	77,471,890	...	...	46,510,941	17,850,481	1,892,621

VALUES IN £ STERLING.

Year	Sugar.	Molasses.	Rum.	Cacao.	Coconuts.	Copra.
1911	580,404	13,086	6,955	1,127,372	78,965	13,264
1912	589,123	7,068	8,502	1,007,690	61,278	28,723
1913	418,067	4,243	10,657	1,403,397	85,369	11,545
Total	1,487,594	24,347	26,126	3,538,459	225,612	53,535
8 years average	495,865	8,116	8,708	1,179,453	75,204	17,845

CROPS ESTIMATED.

	£		Lb.	\$
Sugar	495,865		Sugar say 77,500,000 3¼ c. p. 1,000	2,906
Molasses	8,116	28·8 per cent.	Cacao „ 46,500,000 1½ c. p. 100	6,975
Rum	8,708		C'nuts (No.) 20,000,000 2½ c. p. 1,000	500
Cacao	1,179,453	66·0 „	Copra lb. 2,000,000 5 c. p. 1,000	100
Coconuts	75,204	4·2 „		
Copra	17,845	1·0 „		
Total	1,785,191	100·0 per cent.		\$10,481

BOARD OF AGRICULTURE ESTIMATES.

January 1 to December 31, 1915.

Salaries.

Mycologist	...	...	...	\$3,360
Entomologist	...	...	...	2,160
Secretary	...	...	...	960
Clerical Assistant...	...	...	...	360
First Agricultural Inspector	...	{	Salary	840
			Horse allce.	240
			Sub	240
			House	120
Second Agricultural Inspector	...	{	Salary	840
			Horse allce.	240
			Sub	240
			Salary	720
Third Agricultural Inspector...	...	{	Horse allce.	240
			Sub	240
				\$10,800 00

Laboratory.

(For Glassware, Entomological and Mycological apparatus, photographic materials, wages of coolie boy, specimen jars, insect cases and cages, chemicals, stains, etc., used in connection with laboratory work)

...	...	...	600 00
Carried forward	...	...	\$11,400 00

Board of Agriculture Estimates.--*Continued.*

Brought forward	...	...	\$11,400 00
<i>Library.</i>			
(For books on Mycology, Entomology and general agricultural topics and for subscriptions to Mycological and Entomological journals which contain articles bearing on Tropical Agriculture)			140 00
<i>Office Contingencies.</i>			
(For postage to foreign countries, on letters and parcels of insects and fungus, repairs to typewriter, necessities for typewriter and petty expenses)	...	...	200 00
<i>Disease Prevention.</i>			
(For Insecticides, Fungicides, Spraying Machinery and accessories, trap lights, etc.)	...	...	800 00
<i>Illustrations, &c.</i>			
(For half tone and coloured plates used in Publication, etc., etc.)	...	...	200 00
<i>Travelling Expenses.</i>			
(Members and Officers of the Board)	...	...	1,000 00
<i>Sugar Cane Nursery.</i>			
(Advance)	...	...	240 00
<i>Prizes for Improved Cacao Cultivation.</i>			
(Prizes, expenses in judging, etc., etc.)	...	...	1,400 00
<i>Auditing Accounts.</i>			
(Audit Office)	...	...	48 00
<i>Estates Experiments.</i>			
(Manures, Salary, etc., of Officer in charge and experiments)	...	...	1,200 00
<i>Imperial Bureau of Entomology, London.</i>			
(Annual Contribution)	...	...	240 00
<i>Board of Industrial Training (Farriery Classes.)</i>			
(Contribution)	...	...	120 00
<i>Joint Agricultural Exhibition, Port-of-Spain, 1915.</i>			
(Contribution)	...	...	500 00
<i>Emergency Vote.</i>			
(For any outbreak of disease, etc.)	...	...	1,000 00
			<hr/> \$18,488 00 <hr/>

The chief alteration in this year's estimate is the provision made for the appointment of a third Agricultural Inspector, and the contribution to the Agricultural Exhibition in Port-of-Spain in February 1915. These additions are mainly responsible for the increase of \$1,820 over the estimates of 1914, given in the *Bulletin XIII.*, 1914, p. 185.

PUBLICATIONS RECEIVED.

Cocoa.*—(By C. J. J. Van Hall, pp. xvi and 515—Macmillan and Co., London, 1914, Price 14s. net.)

Dr. Van Hall is so well known in this quarter of the globe that any book written by him is sure to attract attention. His experience in cacao cultivation will always be remembered in connection with the sweeping ravages of the witch broom disease in Surinam.

His book covers over 500 pages and contains 140 excellent illustrations. There are eleven chapters on the following subjects:—Historical; Geographical; Distribution and Climatic Conditions; the Chemistry of Cacao and Cacao Soils; the Botanical characteristics of the Cacao Plant; Varieties of Cacao; the Cultivation of Cacao; Fermentation, Washing and Drying; Diseases and Enemies; Cacao Growing Countries; Commerce, and Notes on Cocoa and Chocolate Industry.

The chapter on cacao growing countries—extending over 192 pages—is a special feature in this book; the chapter on cultivation—the next longest—reaches 106 pages, and that on diseases 56 pages. The remaining chapters are each below 32 pages in extent.

A careful perusal of the chapter on Cacao Growing Countries will well repay the reader. Practically every leading feature of cacao cultivation in each country is described, and Trinidad planters will have an opportunity of comparing their methods with those of other countries and will probably arrive at the conclusion that they compare favourably with those of other planters.

Of the Gold Coast, of which much has been heard lately, he says: "Generally speaking, cacao growing on the Gold Coast may be called in every sense a haphazard one. The weeds are left growing too long between the trees; pruning is very rarely done, and even suckers are generally left It is not to be wondered at that trees treated in this way have only a short life and, as is reported, they often begin to die at the age of 12 years. By cutting the whole tree back, leaving only a stump of the stem a new growth can be obtained and the life of the tree may be lengthened."

Dr. Van Hall in the Trinidad part makes use of the information contained in the books on Cacao by Olivieri, Hart, and Preuss, the *Proceedings of the Agricultural Society, Trinidad and Tobago*, the *Bulletin of the Botanical Department* and its successor the *Bulletin of the Department of Agriculture*, the *West Indian Bulletin* and the *Trinidad Year Book*.

Under the head of Trinidad rainfall Dr. Van Hall has been misled, like many others who have not resided in the colony for any length of time, into the belief that the rainfall throughout the island is the same as at St. Clair and St. Ann's which are situated in a comparatively dry quarter. He draws from the rainfall of these two stations these erroneous conclusions. "These figures show that the rainfall in Trinidad is not very heavy for cacao cultivation, and it could not be much less without being insufficient. In the dry months (January to April) the cacao suffers

* In the review "Cacao" has been substituted for "Cocoa" except as usual for the manufactured product.

sometimes very much and in years with heavy drought many trees and sometimes whole areas die, especially where the shade is scarce. From these facts the planters regard a rather dense shade as necessary. On the cacao plantation La Reunion the rainfall seems to be greater being in 1896, 1897, and 1898, 2730, 2580, and 2390 m.m."* The rainfall of some 80 or 90 stations in different districts of Trinidad have been so regularly published that it is unfortunate that the writer has fallen into this error. Capitalists would be deterred from investing money in cacao estates in Trinidad if the general rainfall were as low as stated in this book.

Trinidad methods of cultivation are described in 26 pages, and several extracts from Olivieri's book are given at length. The exports from each country are given for a number of years and this chapter will be highly appreciated.

The next longest chapter deals with the cultivation of cacao. The following sentence in the second paragraph indicates the predominance given to the practical side.—"In reading this chapter, therefore, the reader should remember the final exhortation of an old teacher of Agriculture, after he had delivered his last lecture to his students, *and now, gentlemen, go into the field and see how others do.*" This advice is very sound. Every aspect of cultivation is dealt with in this chapter. The question of shade has received considerable attention. One quotation under this head will prove of local interest: "it is therefore an advantage to have a species of shade tree which defoliates in the dry season. This fact is also often misunderstood, and even some authors on cacao incorrectly assert that a shade tree should keep its leaves during the dry season in order to keep the soil moist."

The author points out that in Barrett's method of "vertical forking" the aeration of the soil is much less thorough than when forking is done in the ordinary way; and planters will readily agree with this view. Many Trinidad planters prefer the ordinary way.

"Golden rules" are given for carrying out manurial experiments, the first being:—"Always include in the series of plots a sufficient number of unmanured *Control Plots* in order to be able to compare the yields on manured and unmanured soil." In Trinidad we have shown that in cacao experiments "Control Plots" dealt with in the usual way may be dangerously misleading. A new factor of primary importance (*viz.* the natural yield of the plots) has been discovered which can no longer be omitted in conducting manurial experiments. The often quoted results of experiments in Dominica are given with the accidental addition of a printer's error in the table. At the time these experiments began in 1902 the influence of "natural yield" was not known or even suspected. Under the special conditions prevailing in the Dominica experiments, mulching has been less expensive than artificial manures; but if carried out on a larger scale and under ordinary conditions mulch would be found to be the most expensive of all manures. In the Dominica experiments there are only five plots, the total area of which is $1\frac{1}{2}$ acres, the trees were ten years old in 1900, and planted 18 feet apart. This works out at only 134 trees to the acre. The actual number of trees in each plot varied between 34 and 40. Cacao experiments even on a small scale

* 10 mm. = 0.39 in., *i.e.* 2,500 mm. = 97.50 in. (Ed.)

are not without practical value, but the conditions should be quoted with much fuller details than are usually given.

Dr. Van Hall draws attention to the abnormally high yields (1,800 and 2,000 lb. of cured cacao per acre) in two of the Dominica plots; they certainly are high, but we have many individual trees at River estate giving a natural yield without manure of over 20 lb. of cured cacao a year and this proves that the *calculated* high yields per acre in Dominica are not necessarily derived from the use of manures.

The Chapter on Fermentation and Drying deserves to be closely studied; and it is needless to add that Dr. Van Hall deals very ably and comprehensively with Diseases and Enemies.

Further light has been thrown on the Witch Broom disease since this book was written, and the most recent investigations point to the conclusion that it is not caused by the fungus *Colletotrichum luxificum* to which Van Hall and Drost had attributed it. Mr. Rorer, the Mycologist to the Trinidad Board of Agriculture, was the first to draw serious attention to the probability of this disease being caused by some other fungus. *

In Chapter IV self-pollination of the flowers is claimed to be proved as the result of investigation by Dr. Von Faber at Buitzenborg.

The following extract will also be read with interest:

"On the other hand, the Venezuelan planters have observed that the presence of the Forastero tree has no effect on the offspring of the Criollo. Even when surrounded by Forastero trees, the Criollo gives always an offspring consisting of pure Criollo trees.

"It may be remembered here that exactly the same facts have been observed in Java, and the present author is able to confirm the observations made by the Java planters: Forastero hybridises and improves in following generations when Criollo trees are in the neighbourhood; Criollo, however, does not hybridise, and remains in following generations pure Criollo in spite of the neighbourhood of Forastero trees."

Mention is made in the eleventh chapter of the Van Houten process, and we are told that in the "Dutch method" after pressing out the fat the cocoa is made soluble by treatment "with carbonate of magnesia, or with carbonate of potassium, of sodium, or of ammonia. This results not really in the 'solubility' of the cocoa in the true sense of the word, but it keeps the powder better suspended in water or milk and not sinking so quickly to the bottom."

It is highly improbable that the addition of alkalis in any form does not alter the natural flavour of the cocoa, their use is not favoured by British manufacturers, and it has always appeared to me injudicious that cocoa manufacturers should make any effort to assist the consumer in swallowing the insoluble, and presumably innutritious, portions. Neither tea nor coffee manufacturers adopt this course.

A very palatable beverage can be prepared from pure cacao without the extraction of its fat or without the addition of any form of starch. The method of suspension of the insoluble part of cacao, by the aid of the mucilage formed when hot water is added to starch, is mainly responsible for the adulteration with starch which, to the serious disadvantage of the

* See Page 323.

cacao producer, is so extensively adopted. A mixture with 70 or 80 per cent. of starch would never have been honoured with the name "food of the gods."

This book contains a valuable store of practical information collected from all the cacao-producing countries of the world. It will find a place in every library connected in any way with agriculture in tropical countries.

The use of the spelling "COCOA" instead of "CACAO" in this book is somewhat surprising.

P. C.

Planting in Uganda.—By E. Brown and H. H. Hunter, pp. xvi and 176. Longmans, Green & Co., London, 1913.

Uganda is one of the countries of the Empire which has made considerable agricultural progress during quite recent years. Formerly the chief exports of Uganda were forest products but now plantations have been formed and there has been a great development along estate lines.

The volume is concerned with three of the introduced crops, rubber, cacao and coffee.

Puntumia elastica is a native of the country but as regards rubber production interest is chiefly centred in Para rubber (*Hevea brasiliensis*) introduced in 1901. Cacao was also introduced in the same year and coffee about the same time although there are wild coffees in Uganda.

As might be expected from the short period during which these plants have been under cultivation but little data are given as to actual commercial returns. The volume is mainly devoted to generalized information of value to the planter, based largely on experience in other countries, Trinidad, in particular, being drawn upon for facts regarding cacao. There are chapters on Insect and Fungoid diseases (the latter by Mr. George Massee of Kew) and these, together with much of the other information, will be read with interest by planters in other parts of the world as well as in Uganda.

W. G. F.

INDIAN CORN.

The imports of maize into this Colony are very much larger than they ought to be, and local producers should make an effort to secure a considerable part of the money sent out of the Colony every year for the purchase of this cattle food. The following table of imports deserves to be carefully considered :—

	<i>Bushels.</i>		<i>Bushels.</i>
1899 ...	75,147	1906-7	37,476
1900 ...	48,458	1907-8	31,958
1901-2	45,980	1908-9	25,956
1902-3	42,058	1909-10	23,403
1903-4	31,542		
1904-5	41,411	1910 ...	1,583,387 lb.
1905-6	34,081	1911 ...	1,106,874 ..

The figures for 1912 and 1913 cannot be given as they are no longer shown separately in the Statistics of imports.

It will be observed that there has been a steady reduction in the imports from nearly 4,000,000 lb. in 1899 to approximately 1,000,000 in 1911; but there should be no necessity to import Indian corn into this Colony where it can be so easily grown and where the method of cultivation is so well understood. 1,000,000 lb. represents in round numbers the cultivation of another 1,000 acres of land the produce from which would find a ready sale in our local markets.

P.C.

METEOROLOGY.

RAINFALL RETURN FROM JANUARY TO NOVEMBER 1914.

STATIONS.	October 1914.		October 1913.		Jan'y. to Oct. 1914.		Nov. 1914.		Nov. 1913.		Jan'y. to Nov. 1914.		Jan'y. to Nov. 1913.	
	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
<i>North West District.</i>														
St. Clair—Royal Botanic Gardens	6.14	3.51	3.56	40.93	20.10	7.61	2.58	8.61	6.48	35.06	48.54	37.71	48.54	37.71
Port-of-Spain—Colonial Hospital	4.69	3.45	6.38	32.00	22.97	4.50	9.88	6.28	6.68	36.50	36.50	28.96	36.50	28.96
" " Royal Gaol	5.32	3.85		35.35	28.14	5.22				40.57		34.82		34.82
" " Constabulary Head-quarters	4.57			32.48	25.16									
St. Ann's—Reservoir	5.37	3.56	6.38	41.40	39.10									
Maraval—Reservoir	6.84	4.78	4.74	41.74	47.09	10.50	9.30	9.50	10.11	51.23	52.24	56.59	51.23	48.71
" " Constabulary Station	11.63	4.21	4.96	49.96	54.95					59.25		65.06		65.06
Diego Martin	10.65	3.25	4.67	46.67	51.29	6.97	6.54	8.64	7.45	53.64	53.64	59.93	53.64	59.93
" " Waterworks	10.81	3.68	4.77	47.27	51.07					53.81		58.52		58.52
" " River Estate	9.83	4.76	4.73	46.73	53.57	6.03	6.54	8.20	7.45	52.76		61.77		61.77
Fort George Signal Station	9.43	4.05	4.07	47.07	36.85	8.90	8.90	8.14	8.14	55.97		45.07		45.07
North Post	9.76	5.40	42.47	42.47	42.83	5.11	5.11	7.11	7.11	47.58		49.94		49.94
Carenage Constabulary Station	12.30	3.32	59.34	59.34	41.34	8.99	8.99	7.38	7.38	68.38		48.72		48.72
Carrera Island Convict Depot	7.70	4.68	41.49	41.49	30.15	3.46	3.46	7.49	7.49	44.95		37.64		37.64
Chacachacare Light House	5.44	2.74		34.57	29.01	1.98		5.10	5.10	36.55		34.11		34.11
<i>Santa Cruz—Maracas District.</i>														
Santa Cruz Constabulary Station	10.94	6.19	45.99	45.99	52.90	8.70	8.70	11.46	11.46	54.39		63.55		63.55
St. Joseph, Government Farm	7.27	6.28	38.13	38.13	37.22	7.00	7.00	5.79	5.79	46.13		43.01		43.01
St. Joseph Constabulary Station	7.05	7.38	33.59	33.59	37.75	5.59	5.59	8.25	8.25	39.18		46.00		46.00
Tunapuna, St. Augustine Estate	5.93	7.40	34.74	34.74	41.14	8.18	8.18	7.82	7.82	42.92		49.00		49.00
Maracas—Government School	13.08	9.06	48.00	48.00	51.98	8.78	8.78	7.65	7.65	56.78		58.73		58.73
" " Ordinola Estate	7.98	7.53	40.72	40.72	45.20	10.18	10.18	7.19	7.19	50.90		52.39		52.39
Caura, Wardour Estate	6.92	9.21	36.98	36.98	39.28	11.34	11.34	8.86	8.86	48.32		48.14		48.14
<i>West Central District.</i>														
Caroni, Frederick Estate	7.06	16.49	83.31	83.31	94.50	9.72	9.72	21.11	21.11	93.03		115.61		115.61
Chaguanas, Constabulary Station	5.33	8.17	39.24	39.24	53.61	4.66	4.66	6.11	6.11	43.90		59.72		59.72

RAINFALL RETURN FROM JANUARY TO NOVEMBER 1914.—CONTINUED.

STATIONS.	October, 1914.		October, 1913.		Jan'y. to Oct., 1914.		Jan'y. to Oct., 1913.		Nov., 1914.		Nov., 1913.		Jan'y. to Nov., 1914.		Jan'y. to Nov., 1913.	
	Ins.		Ins.		Ins.		Ins.		Ins.		Ins.		Ins.		Ins.	
<i>West Central District.—Contd.</i>																
Chaguanas, Woodford Lodge Estate	4.79		8.43		40.88		53.39		4.94		6.35		45.82		59.74	
Carpicheima, Waterloo Estate	3.80		4.75		34.27		46.27		6.54		5.96		40.81		52.23	
Couva, Exchange Estate	4.40		7.80		37.51		52.73		7.15		10.27		44.05		63.00	
" Brechin Castle	5.63		6.50		33.34		37.35		5.54		6.08		38.88		44.03	
" Perseverance	5.75		6.45		38.36		45.25		6.77		7.51		45.13		52.76	
" Camden	5.39		4.88		41.72		40.92		6.73		7.35		48.45		47.41	
" Milton	6.52		4.95		32.34		40.96		5.65		6.45		37.99		50.29	
" Spring	9.41		8.45		39.58		43.53		6.56		6.76		46.14		53.58	
" Constabulary Station	6.17		5.69		30.33		45.80		7.12		7.78		43.45		48.97	
" Esperanza Estate, Savonetta	6.82		5.97		38.56		40.88		6.33		7.19		44.89		46.50	
"	6.15		5.96		35.86		40.01		6.17		6.49		42.03			
<i>San Fernando & Princes Town District.</i>																
Claxton's Bay, Forbes Park Estate	4.80		7.38		38.52		36.69		4.21		6.17		42.73		42.86	
Pointe-à-Pierre, Bonne Aventure Est.	6.93		5.97		36.27		43.54		7.40		7.34		43.87		50.88	
" Concord Estate	8.44		9.46		40.29		47.11		7.23		7.65		47.52		54.76	
" Plain Palais Estate	5.97		6.95		34.35		41.07		5.76		6.26		40.11		47.33	
Naparima, Pictou Estate	3.18		4.11		28.98		31.18		6.22		8.00		36.20		39.19	
" Usine Ste. Madeleine Est.	4.63		5.10		36.21		51.00		5.50		9.85		41.71		60.85	
" La Fortunée Estate	6.35		4.81		34.06		49.81		7.69		8.32		41.75		46.17	
" Lewisville	6.43		7.17		41.44		44.81		5.13		10.92		46.57		60.73	
" Tarouba Estate	4.90		6.15		27.72		34.98		3.62		7.88		31.34		42.86	
" Union Hall Estate	5.26		5.41		33.41		39.15		5.85		8.59		38.26		47.74	
" Palmiste	4.39		5.37		35.48		43.70		6.63		8.77		42.11		52.47	
" Hermitage	4.80		4.67		34.32		38.41		5.83		9.15		40.15		48.06	
Princes Town, Craignish Estate	4.74		7.71		41.86		44.51		5.64		10.13		47.50		54.44	
" Cedar Hill Estate	1.87		5.51		39.78		42.27		5.69		10.93		45.47		53.20	
" Williamsville Estate	6.66		7.71		41.88		45.48		7.76		8.28		49.64		53.76	
" Emerald Estate	7.21		7.14		45.54		47.70		6.97		9.38		52.51		57.08	

RAINFALL RETURN FROM JANUARY TO NOVEMBER 1914.—CONTINUED.

STATIONS.	Oct. 1914.	Oct. 1913.	Jan'y. to Oct. 1914.	Jan'y. to Oct. 1913.	Nov. 1914.	Nov. 1913.	Jan'y. to Nov. 1914.	Jan'y. to Nov. 1913.
<i>San Fernando & Princes Town District.</i>								
Princes Town New Grant Estate	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
" Constabulary Station	7.39	8.39	51.20	47.83	6.48	12.17	57.68	60.00
" " Hindustan Estate	5.71	4.71	27.12	34.90	5.40	7.95	32.52	42.85
" " La Retraite Estate	5.93	7.63	42.32	46.22	5.13	9.60	47.65	55.83
" " La Retraite Estate	10.65	8.73	66.27	65.06	8.42	13.36	74.69	78.42
Sav. G'de, Friendship & Ben Lomond Ests.	5.16	6.69	39.35	41.08	5.66	10.41	45.01	51.49
Poole, El Rosario Estate	6.11	6.69	40.49	41.13	6.23	9.98	46.72	51.11
<i>Montserrat District.</i>								
Montserrat, Constabulary Station	5.91	6.71	53.96	60.68	8.44	14.71	61.50	75.39
Brasso, La Vega Estate	6.81	7.82	39.48	48.48	8.08	8.70	46.56	57.18
<i>Arima District.</i>								
Arima, Warden's Office	10.14	5.20	48.66	56.03	7.64	12.10	56.30	68.13
Arima, Torrecilla Estate	5.38	8.88	38.12	44.82	3.26	10.09	41.38	54.91
Arima, Verdant Vale Estate	12.13	13.95	59.16	64.34	9.96	12.27	69.12	76.61
San Rafael, Constabulary Station	11.76	12.09	56.12	60.71	8.72	13.59	64.84	74.30
Guanapo, Talparo Estate	7.87	7.61	62.30	71.72	8.89	11.10	71.19	82.82
Guanapo, San José Estate	5.19	6.79	50.03	67.41	8.18	10.77	58.21	78.68
Tamana, Santa Maria Estate	7.67	8.60	61.55	77.54	10.35	11.10	74.05	88.64
<i>South-West District.</i>								
Oropuche, Constabulary Station	8.07	4.22	49.17	42.03	9.31	11.90	58.48	53.93
" Pluck Estate	8.63	4.83	38.88	33.65	7.03	9.48	45.91	43.13
Siparia, Constabulary Station	10.66	8.14	57.78	60.56	11.68	16.20	69.46	76.76
" Alta Gracia Estate	6.79	8.33	44.22	43.90	8.56	12.75	50.20	56.65
Guspo, Adventure Estate	7.26	10.26	64.09	64.38	5.98	16.31	72.31	80.69
Cap-de-Ville, Constabulary Station	9.14	10.26	65.14	64.09	8.23	9.81	50.79	64.43
Erin, La Ressource Estate	7.70	8.71	45.49	54.62	5.65	6.17	53.51	64.43
" Industry Estate	4.47	6.51	47.34	43.06	6.17	9.32	53.51	64.43
Cedros, Constabulary Station	5.39	6.65	43.06	35.45	4.23	8.45	47.29	43.90

RAINFALL RETURN FROM JANUARY TO NOVEMBER, 1914.—Continued.

STATIONS.	Oct. 1914.	Oct. 1913.	Jan'y. to Oct. 1914.	Jan'y. to Oct. 1913.	Nov. 1914.	Nov. 1913.	Jan'y. to Nov. 1914.	Jan'y. to Nov. 1913.
	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
Cedros, Perseverance Estate	4.97	6.01	40.95	31.37	4.41	6.33	45.36	37.83
Icaoso, Constance Estate	4.75	6.30	36.85	51.73	3.00	6.56	39.85	67.02
Iroir, Irois Estate	No record kept	7.40	...	...	12.09	15.89	...	...
<i>South Coast.</i>								
Moruga, Constabulary Station	4.69	5.35	35.90	42.92	3.93	13.16	39.02	56.08
<i>North Coast.</i>								
Blanchisseuse, Constabulary Station	7.33	6.26	48.60	67.14	6.31	14.48	54.91	81.62
Grande Riviere, Mon Plaisir Estate	7.85	7.49	60.35	90.69	17.00	23.95	77.95	114.64
Toco, Aragua House	11.43	6.85	48.59	62.02	7.21	16.93	56.80	79.55
" Constabulary Station	11.08	6.85	45.21	54.80	8.07	15.49	53.28	70.29
Point Galera, Light House	9.14	5.37	28.41	31.41	5.06	9.62	33.47	41.03
<i>East Coast.</i>								
Matuna, La Juanita Estate	11.04	6.79	59.84	79.17	7.23	17.13	67.07	96.30
Manzanilla, Constabulary Station	7.75	6.24	56.13	65.57	10.06	15.50	66.19	81.07
Sangre Grande, Sta. Estrella Estate	8.02	10.12	61.29	79.57	13.03	16.81	74.32	96.38
" New Lands Estate	9.83	7.43	57.51	74.05	12.12	11.57	69.63	85.62
" Evasdale Estate	8.49	8.72	64.88	80.57	11.54	14.62	76.42	95.19
" Grosvenor Estate	10.36	8.09	60.23	75.20	13.33	15.96	73.56	91.16
Mayaro, Constabulary Station	4.74	11.05	36.13	52.72	8.14	9.73	44.27	62.45
<i>Tobago.</i>								
Tobago, Hermitage Estate	11.05	6.56	51.94	63.73	10.05	14.76	61.99	78.49
" Riverdale	6.23	7.15	32.15	45.05	3.78	8.76	35.93	53.81
" King's Bay	6.14	6.92	43.05	54.86	7.33	13.17	50.38	68.03
" Roxburgh	9.24	10.81	52.61	68.27	6.74	11.48	59.35	79.75
" Lure	8.12	12.37	67.50	67.50	7.65	10.56	61.51	78.06
" Botanic Station	3.01	7.75	36.73	45.06	7.30	8.31	44.03	53.37
" Government Farm	6.01	5.06	20.31	30.75	5.61	5.66	25.92	36.41
" Lowlands Estate	4.27	5.28	28.42	36.00	5.91	8.20	34.33	44.20
" Friendship Estate	3.32	6.13	30.02	36.95	6.54	8.16	37.16	45.11

NOTES.

Prof. P. Carmody, Director of Agriculture, returned from leave and resumed the duties of his appointment on November 4.

The vacancies on the Board of Agriculture caused by the resignation of Messrs. John Moodie and F. J. Morris (*see* p. 802) have been filled by the appointment by His Excellency the Governor of Mr. C. Forbes Todd, Manager of the Usine St. Madeleine, and Mr. James Black, Manager of Waterloo Sugar estate.

Mr. R. J. Link, Overseer at the Government Farm, late of the Second Life Guards, has been granted special leave of absence to enable him to go to the front.

Messrs. A. C. Miles and C. Saunders of the Gold Coast Department of Agriculture have recently been on an official visit to the Colony studying cacao cultivation. They gave an interesting account of Gold Coast methods at the meeting of the Agricultural Society on November 18.

The first joint exhibition of the Horticultural Club and the Poultry and Pet Stock Association was held on December 4 and 5, the proceeds being devoted to the War Funds. The standard of the poultry exhibits was very high. The horticultural exhibits were very fair considering the lateness of the season and the short notice at which the show was arranged.

Mr. H. Meaden, Officer in charge of the Botanic Station and Manager of the Government Farm, Tobago, has been appointed an Inspector under the Plant Protection Ordinance.

BULLETIN

DEPARTMENT OF AGRICULTURE,
Trinidad and Tobago.

PART I.]

1915.

[VOL. XIV.

CACAO.

MANURIAL EXPERIMENTS ON CACAO 1913-14.

By JOSEPH DE VERTEUIL, F.C.S.,
Superintendent of Field Experiments.

THIS report deals with the third year's results of the manurial experiments on cacao, under the control of the Board of Agriculture, and is in continuation of the reports for 1911-12* and 1912-13; † it also contains the results of the natural yield plots for the last two years.

The results obtained during the period from September 1, 1913 to August 31, 1914 are given for each estate respectively, under Tables I to VIII, and the average number of pods picked per tree for the two previous periods of twelve months is also recorded for comparison.

The manures were applied broadcast to within three feet of the trunk of each tree, about two feet from the edge of the drains, and the soil forked to a depth of about six inches. The control plots were also forked but no manures added. Where basic slag, sulphate of potash and sulphate of ammonia have been applied to a plot, the sulphates of potash and ammonia were applied two months after the slag. In the case of lime and superphosphate of lime, the latter was applied two months after the lime.

In calculating the results recorded in the various tables, throughout this report, it has been assumed that twelve pods produce a pound of dry cacao, and the value of the marketable cacao has been fixed at eleven cents (5½d.) per pound.

Weather conditions have been very favourable during the period under review, for although the rainfall was less than in 1912-13 the precipitations have been more evenly distributed and the dry season preceding the crop was comparatively mild. Not only do the plots show a large increase over previous years but the output of cacao for the Colony is the greatest on record. The fundamental importance of a favourable season is seen at a glance at most of the diagrams, the increase in crop over that of last year being in several cases as great in the no manure (or control) plots as in those under manurial treatment.

* *Bulletin, Department of Agriculture.* xi. 1912, pp. 145-155.

† *Bulletin, Department of Agriculture.* xii. 1913, pp. 205-216.

In connection with these experiments, it should be mentioned that no work of any special nature was done to the plots on any of the estates, with the exception of the dynamiting experiment at Santa Marta (see below). The plots are cultivated in the same manner as the rest of the estate, except in so far as the application of manures is concerned, as it would be undesirable to conduct experiments on lines which are not likely to be adopted by the general planter.

Throughout this report data relating to control plots mean the average for the control plots.

The yield of each plot during the three years is shown graphically for each estate respectively, so that the increase or decrease for the various plots from year to year can be seen at a glance. The explanation given at the foot of Diagram I applies also to all the other diagrams.

SANTA MARTA ESTATE—TAMANA.

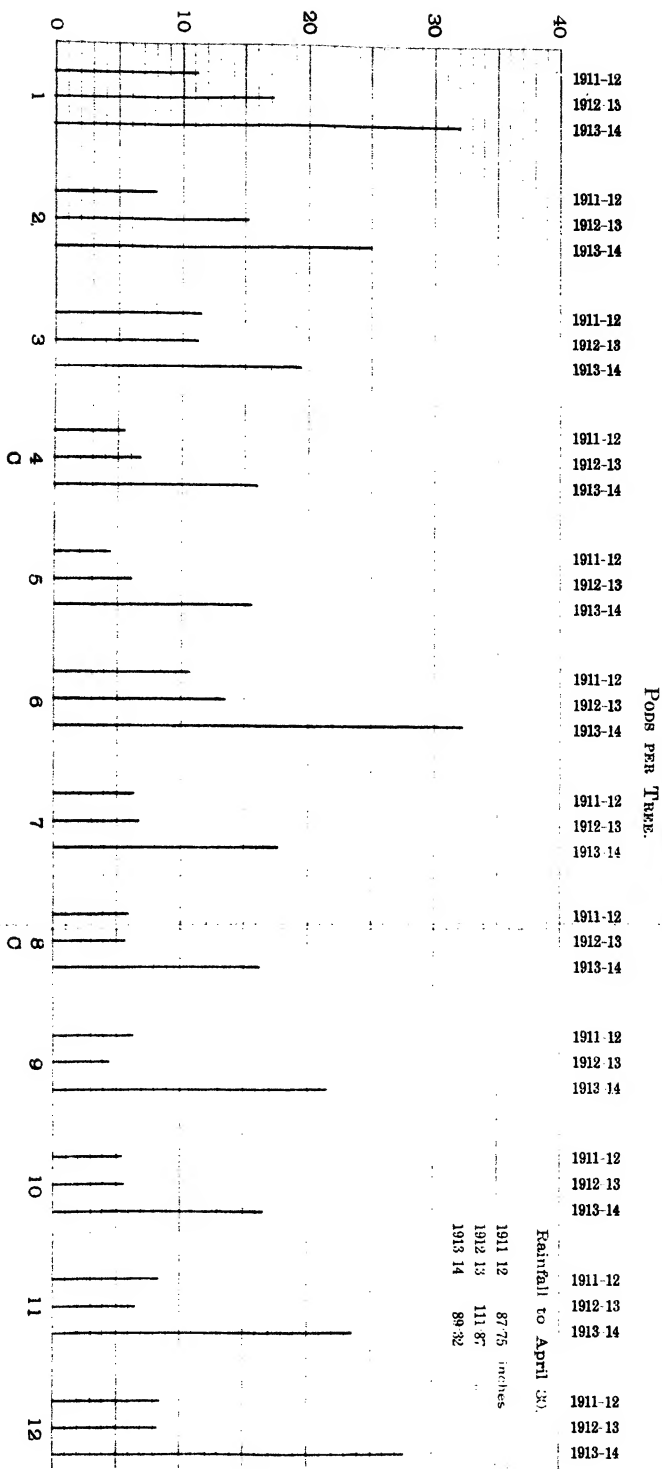
The manures were applied in June, 1913 and 89·32 inches of rain were registered from May 1, 1913 to April 30, 1914. From this year no further applications of lime will be made to plots 9 and 10 on this estate, as the soil naturally contains a sufficient supply of this ingredient.

There has been a large increase in the yield of all the plots for the period under review, and 1,449 lb. more of dry cacao have been reaped than in 1911-12. With the exception of plot 8, the increase obtained from the manured plots is greater than that from the control plots, and in the case of plots 1, 2, 6, 9, 11 and 12 the increase is quite appreciable. The increase from the control plots is 3,087 pods, against 4,543 pods per acre from the average of the manured plots.

The field under experiment is the worst on the estate, and was specially selected on that account. As there was practically no improvement in the yield of the trees during the first two years, it was thought advisable to try the effect of dynamite on the soil, which is a stiff, heavy clay. Accordingly during the first week of June, 1914, half cartridges (a quarter pound each) of Dupont's Red Cross dynamite were exploded at a depth of about three feet between every two cacao trees in each plot, except No. 4, so that the charges were about 12 feet apart. The effect on the soil was good, very few "blow outs" having been experienced, especially after the first day, when the labourers had got into the correct way of tamping. A limestone formation was occasionally met at a depth of 2 feet 6 inches to 3 feet. It was also observed that holes drilled a couple of days in advance collected water and there is reason to believe that in the rainy season water stagnates 2 to 3 feet below the surface of the soil and cannot be removed by ordinary drainage. Control plot 4 was not dynamited so as to form a check on control plot 8 which was dynamited; it will be observed that the yields from these two plots have been very uniform during the past three years.

The additional cost of this dynamiting experiment was \$87.60 (£7 16 8) per acre.

Diagram I.—Comparative yield of plots for three years on Santa Marta Estate.



EXPLANATION.—The plots are indicated by the number 1, 2, 3, 4, etc. C. means control or no measure plots.

Each distance from 0 to 10, 10 to 20, etc. represents ten (10) pods per tree and therefore the distance from any one horizontal line to the next is equivalent to one (1) pod per tree.

The average number of pods picked per tree from each plot, for each of the three years, has been plotted to scale and is therefore shown by the length of the vertical black lines.

TABLE I.- MANURIAL EXPERIMENTS—SANTA MARTA ESTATE.

Trees 20 to 25 years old in 1911.

Plot.	manures applied per tree.	Average number of pods picked per tree 1911-12.	Average number of pods picked per tree 1912-13.	YIELD—SEP. 1, 1913 TO AUG. 31, 1914.					
				Average No. of pods picked per tree.	Per acre of 300 trees.				
					No. of pods picked.	Lb. dry cacao.	Value of dry cacao at 11 cents per lb.	Cost of manuring.	Col. A less Col. B.
						(A) \$ c.	(B) \$ c.		\$ c.
1	{ 2 lb. Basic slag ½ „ Sulphate of potash }	11-33	17-29	32-04	9,612	801	88.11	9.70	78.41
2	{ 2 lb. Basic slag ½ „ Sulphate of potash ½ „ Sulph. of ammonia }	8-04	15-23	25-02	7,506	625	68.75	14.80	53.95
3	{ 2 lb. Basic slag 1 „ Nitrate of soda }	11-52	11-31	19-48	5,844	487	53.57	14.36	39.21
4	Control—No manure	5-59	6-83	15-96	4,788	399	43.89	...	43.89
5	{ 2 lb. Bone meal ½ „ Sulphate of potash ½ „ Sulph. of ammonia }	4-32	6-01	15-73	4,719	393	43.23	17.23	26.00
6	{ 1 lb. Bone meal ½ „ Sulphate of potash ½ „ Sulph. of ammonia 75 „ Pen manure }	10-91	13-65	32-10	9,630	802	88.22	33.80	54.42
7	{ 1 lb. Superphosph. of lime ½ „ Sulphate of potash ½ „ Nitrate of soda }	6-31	6-94	17-72	5,316	443	48.75	13.24	35.49
8	Control—No manure	5-94	5-54	16-15	4,845	404	44.44	...	44.44
+ 9	Nil	6-25	4-39	21-69	6,507	542	59.62	...	59.62
+ 10	1 lb. Superphosph. of lime	5-16	5-57	16-58	4,974	414	45.34	4.85	40.69
11	{ ½ lb. Sulphate of potash ½ „ Sulph. of ammonia }	8-07	6-44	23-52	7,056	588	64.68	9.66	55.02
12	{ ½ lb. Sulphate of potash ½ „ Sulph. of ammonia 75 „ Pen manure }	8-16	8-11	27-64	8,292	691	76.01	26.34	49.67

* Dividing the figures in these columns by 2 gives approximately number of bags, 165 lb.) dry cacao per 1,000 trees.

+ 3 lb¹ lime per tree in 1911.

ESPERANZA ESTATE—CALIFORNIA.

The artificial manures were applied on June 14 and the pen manure on July 17, 1913; the rainfall from May 1, 1913 to April 30, 1914 was 47·68 inches, *i.e.* it has been low throughout the three years.

All the plots on this estate show an increase on the previous year's returns and, with the exception of plots 3, 8, 9 and 13, the yield is better than in 1911-12. Although only 21 lb. more of dry cacao have been reaped from the plots than in 1911-12, it should be pointed out that the manured plots have given an increase of 516 pods per acre as against a decrease of 125 pods for the control plots.

Plots 1, 2, 5, 6, 7, 11 and 12 have given a larger increase than control plot 4. The other control plots 8 and 13 show a slight decrease on crop 1911-12.

TABLE II.—MANURIAL EXPERIMENTS—ESPERANZA ESTATE.

Trees 9 to 10 years old in 1911.

Plot.	Manures applied per tree.	Average number of pods picked per tree 1911-12.	Average number of pods picked per tree 1912-13.	YIELD—SEP. 1, 1913, TO AUG. 31, 1914.					
				Average No. of pods picked per tree.	Per acre of 253 trees.				
					No. of pods picked.	Lb. dry cacao.	Value of dry cacao at 11 cents per lb.	Cost of manur- ing.	Col. A less Col. B.
						(A) \$ c.	(B) \$ c.	\$ c.	
1	{ 2 lb. Basic slag 1/2 „ Sulphate of potash }	16·18	12·14	18·34	4,732	394	43·34	8·18	35·16
2	{ 2 lb. Basic slag 1/2 „ Sulphate of potash 1/2 „ Sulph. of ammonia }	15·55	12·12	16·99	4,383	365	40·15	12·56	27·59
3	{ 2 lb. Basic slag 1 „ Nitrate of soda }	15·49	10·53	14·21	3,606	305	33·55	12·18	21·37
4	Control—No manure	15·24	10·88	15·80	4,076	340	37·40	...	37·40
5	{ 2 lb. Bone meal 1/2 „ Sulphate of potash 1/2 „ Sulph. of ammonia }	14·84	12·39	21·79	5,622	461	51·48	14·65	36·83
6	{ 1 lb. Bone meal 1/2 „ Sulphate of potash 1/2 „ Sulph. of ammonia 75 „ Pen manure }	16·65	12·65	18·89	4,874	406	44·66	22·74	21·92
7	{ 1 lb. Superphosph. of lime 1/2 „ Sulphate of potash 1/2 „ Nitrate of soda }	14·83	10·84	16·66	4,298	358	39·38	11·21	28·17
8	Control—No manure	14·22	6·42	12·24	3,158	263	28·93	...	28·93
9	3 lb. Lime ...	12·66	5·30	9·86	2,544	212	23·32	3·01	20·31
10	{ 3 lb. Lime 1 „ Superphosph. of lime }	11·44	9·20	11·55	2,980	248	27·28	6·81	20·47
11	{ 1/2 lb. Sulphate of potash 1/2 „ Sulph. of ammonia }	12·03	7·93	16·45	4,239	353	38·83	8·14	30·69
12	{ 1/2 lb. Sulphate of potash 1/2 „ Sulph. of ammonia 75 „ Pen manure }	9·91	6·46	14·86	3,834	319	35·09	18·39	16·70
13	Control—No manure	11·23	6·40	11·20	2,890	241	26·51	...	26·51

* Vide Table I.

Diagram II.—Comparative yield of plots for three years on Esperanza Estate.

PODS PER TREE.

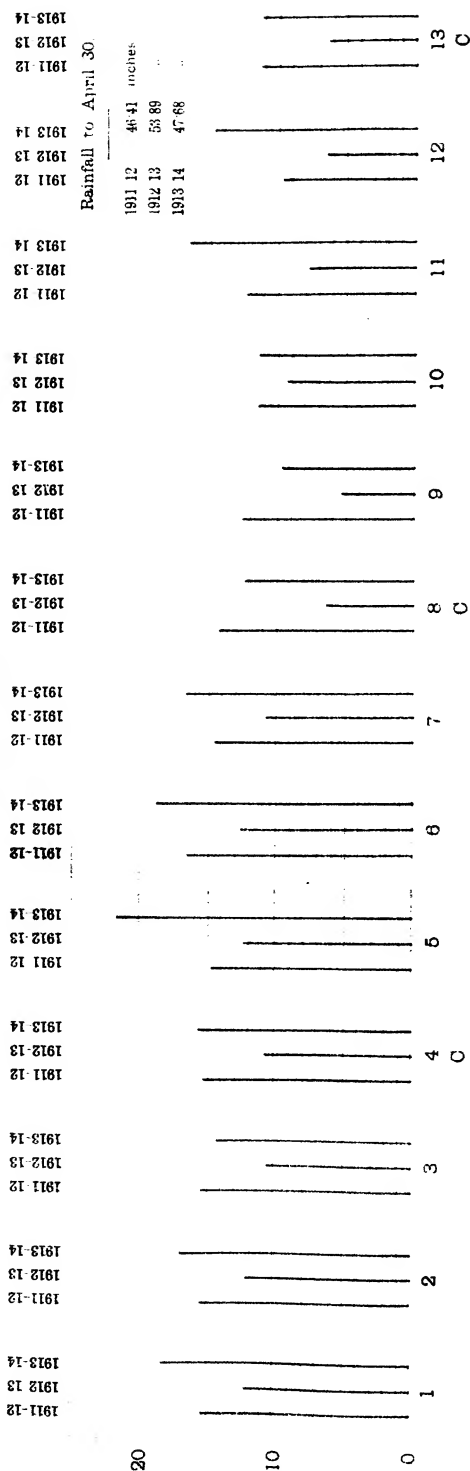
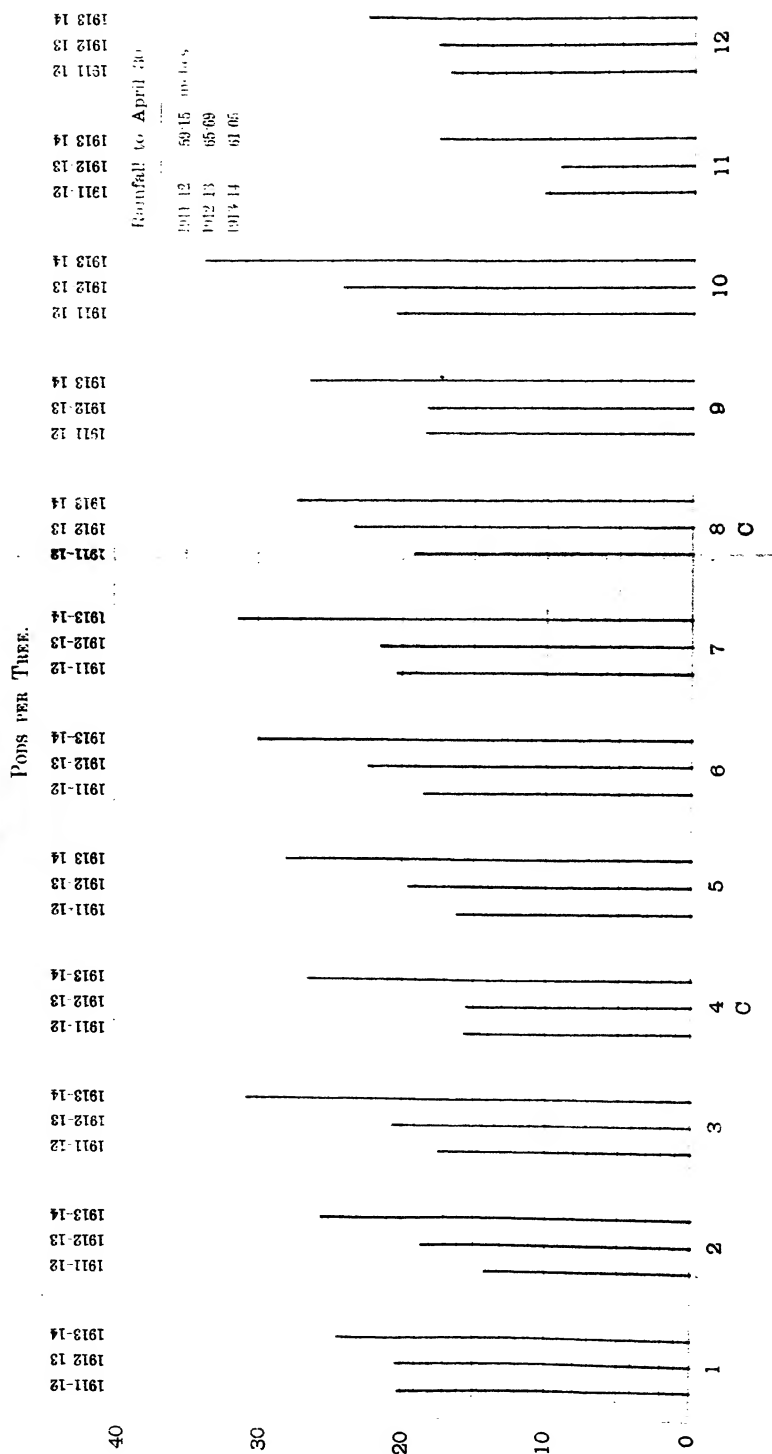


Diagram III. - Comparative yield of plots for three years on New Grant Estate



NEW GRANT ESTATE—PRINCES TOWN.

The manures were applied during the last two weeks of March, 1913, and 61.05 inches of rain were registered on this estate for the twelve months ending April 30, 1914.

As in previous years, no pen manure could be obtained for plots 6 and 12.

All the plots have given a further increase in yield and 136 pounds more of dry cacao have been reaped than during 1911-12. The manured plots show an average increase of 2,942 pods compared with 2,806 pods per acre from the control plots. Plots 2, 3, 5, 6, 7 and 10 have given a larger increase than either of the control plots.

TABLE III.—MANURIAL EXPERIMENTS—NEW GRANT ESTATE.

Trees 11 years old in 1911.

Plot.	Manures applied per tree.	Average number of pods picked per tree 1911-12.	Average number of pods picked per tree 1912-13.	Average No. of pods picked per tree.	YIELD—SEP. 1, 1913 TO AUG. 31, 1914.				
					Per acre of 300 trees.				
					No. of pods picked.	Lb. dry cacao.	Value of dry cacao at 11 cents per lb.	Cost of manuring.	Col. A. less Col. B.
							(A) \$ c.	(B) \$ c.	\$ c.
1	{ 2 lb. Basic slag 1/2 .. Sulphate of potash }	20.06	20.40	24.34	7,302	608	66.88	11.08	55.80
2	{ 2 lb. Basic slag 1/2 .. Sulphate of potash 1/2 .. Sulph. of ammonia }	14.16	18.56	25.65	7,695	641	70.51	17.86	52.65
3	{ 2 lb. Basic slag 1 .. Nitrate of soda }	17.29	20.57	30.87	9,261	772	84.92	15.73	69.19
4	Control—No manure	15.88	15.60	26.50	7,950	662	72.82	...	72.82
5	{ 2 lb. Bone meal 1/2 .. Sulphate of potash 1/2 .. Sulph. of ammonia }	19.11	19.85	27.99	8,397	706	77.09	18.81	58.19
6	{ 1 lb. Bone meal 1 .. Sulphate of potash 1 .. Sulph. of ammonia }	18.42	22.30	30.05	9,015	751	82.61	12.01	70.60
7	{ 1 lb. Superphosph. of lime 1 .. Sulphate of potash 1 .. Nitrate of soda }	20.30	21.52	31.19	9,357	780	85.80	14.81	70.99
8	Control—No manure	19.06	23.33	27.15	8,145	679	74.69	...	74.69
9	3 lb. Lime ...	18.16	18.40	26.37	7,911	659	72.49	4.68	67.81
10	{ 3 lb. Lime 1 .. Superphosph. of lime }	20.39	24.06	33.90	10,170	847	93.17	11.17	82.00
11	{ 1/2 lb. Sulphate of potash 1/2 .. Sulph. of ammonia }	10.34	9.08	17.57	5,271	439	48.29	11.11	37.18
12	{ 1/2 lb. Sulphate of potash 1 .. Sulph. of ammonia }	16.92	17.59	22.27	6,681	557	61.27	6.83	54.44

* *Filed* Table I.

SANTA TERESA ESTATE—CUMUTO.

The manures were applied during the first fortnight of April 1913, and the rainfall in the district for twelve months to April 30, 1914 was 88.46 inches.

The mixture applied to plot 9 consisted of the following:—

120 lb. bone meal, 48 lb. superphosphate of lime, 86 lb. nitrate of soda, 24 lb. calcium nitrate.

All the plots have given a large increase over the two previous years. Compared with 1911-12, plot 4 alone has given a larger increase than either of the control plots, but the increase from plots 5, 6, 8 and 9 is slightly more than that from the control plots. Taken together the manured plots show an increase of 5,054 pods per acre against an increase of 5,029 pods from the control plots. The increase obtained on this estate during the period under review would therefore appear to be due principally to the favourable season.

TABLE IV.—MANURIAL EXPERIMENTS, SANTA TERESA ESTATE.

Trees 40 to 45 years old in 1911.

Plot	Manures applied per tree.	Average number of pods picked per tree 1911-12.	Average number of pods picked per tree 1912-13.	YIELD—SEP. 1, 1913, TO AUG. 31, 1914.				
				Average number of pods picked per tree.	Per acre of 300 trees.			
					No. of pods picked.	Lb. dry cacao.	Value of dry cacao at 11 cents per lb.	Cost of manuring. Col. A. less Col. B.
						(A)	(B)	
						% c.	% c.	% c.
1	{ 2 lb. Basic slag ½ „ Sulphate of potash }	16.25	14.22	32.46	9,738	811	89.21	9.92
2	{ 2 lb. Basic slag ½ „ Sulphate of potash ½ „ Sulph. of ammonia }	19.81	22.33	29.84	8,952	746	82.06	15.46
3	Control—No manure	12.19	16.30	30.40	9,120	760	83.60	...
4	{ 2 lb. Bone meal 1 „ Nitrate of soda }	18.70	24.89	39.76	11,928	994	109.34	19.54
5	{ 2 lb. Bone meal 1 „ Calcium nitrate }	17.19	25.62	35.29	10,587	882	97.02	19.05
6	{ 1½ lb. Superphosph. of lime ¾ „ Sulphate of potash ¾ „ Sulph. of ammonia }	10.57	16.12	27.83	8,349	696	76.56	13.96
7	Control—No manure	13.38	12.38	28.70	8,610	717	78.87	...
8	{ 1 lb. Bone meal 1 „ Superphosph. of lime ½ „ Sulphate of potash ½ „ Nitrate of soda }	14.65	15.25	31.75	9,525	794	87.34	16.45
9	1½ lb. "Mixture"	12.35	16.44	30.52	9,156	763	83.93	9.20

* Vide Table I.

Diagram IV. — Comparative yield of plots for three years on Santa Teresa Estate.

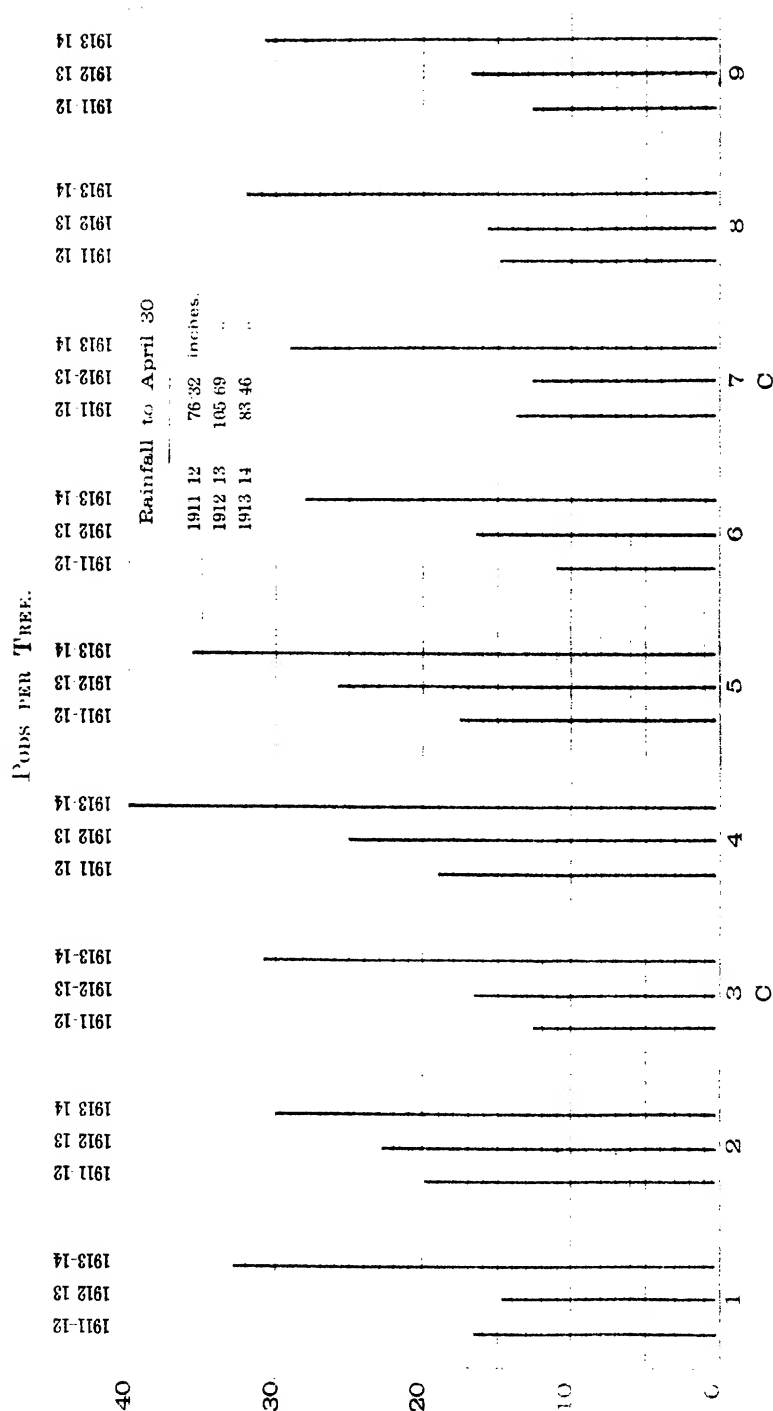
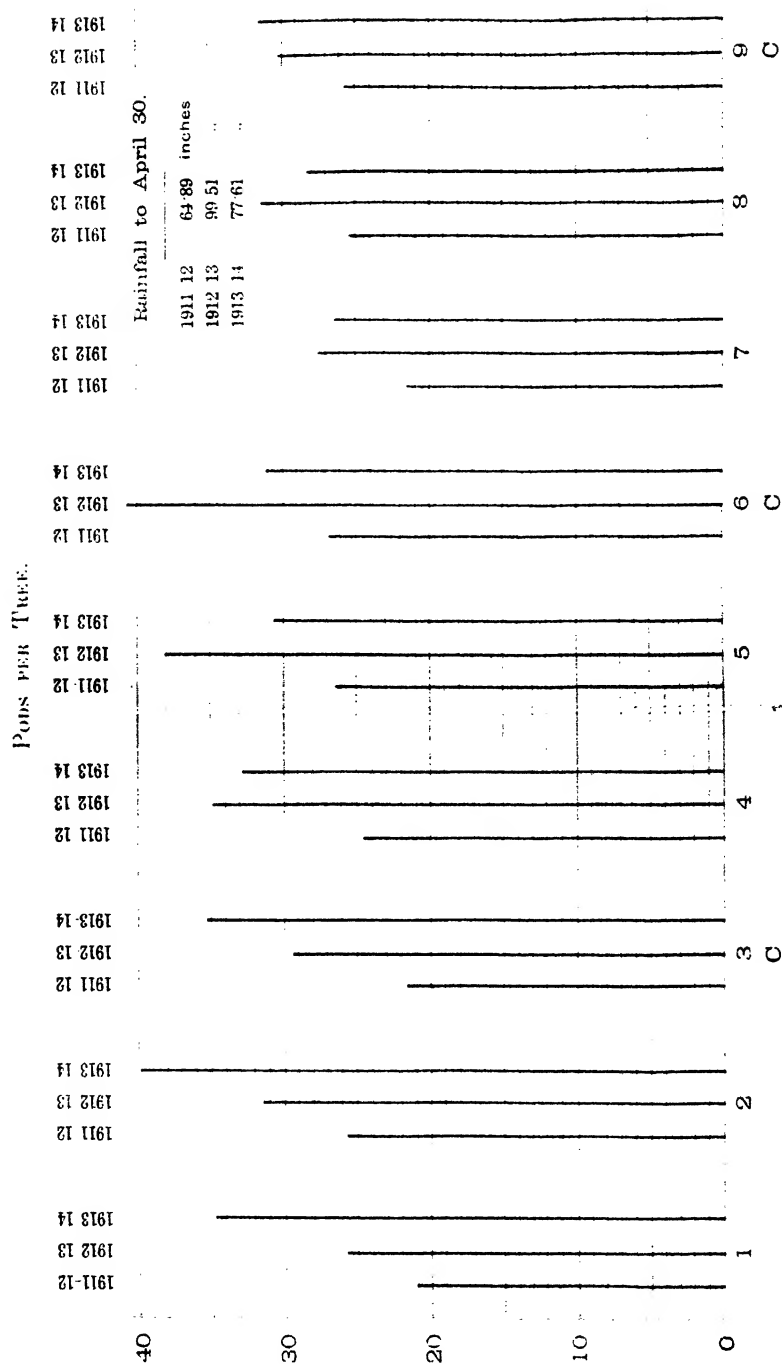


Diagram V.—Comparative yield of plots for three years on Perseverance Estate.



PERSEVERANCE ESTATE—TALPARO.

The manures were applied on March 17, 1913, and the rainfall registered on the estate for the twelve months from May 1, 1913 to April 30, 1914 was 77.61 inches.

All the plots have given an increase, and 1,611 lb. more of dry cacao have been reaped than for the crop of 1911-12. Plots 1 and 2 have given a larger increase than the control plots, but the increase from all of the manured plots is 2,350 pods per acre against 2,449 pods from the control plots. As in the case of the Santa Teresa experiments the increase obtained during the year appears to be due principally to favourable climatic conditions. It may be pointed out that the trees on both of these estates are about 40 years old, and are situated on heavy clay soils on the banks of the Cumuto and Talparo rivers respectively.

TABLE V.—MANURIAL EXPERIMENTS—PERSEVERANCE ESTATE.

Trees 35 to 40 years old in 1911.

Plot.	Manures applied per tree.	Average number of pods picked per tree 1911-12.	Average number of pods picked per tree 1912-13.	Average number of pods picked per tree.	YIELD - SEPT. 1, 1913 TO AUG. 31, 1914				
					Per acre of 300 trees.				
					No. of pods picked.	Lb. dry cacao.	Value of dry cacao at 11 cents per lb.	Cost of manuring.	Col. A less Col. B.
						(A)	(B)		
						£ s. d.	£ s. d.	£ s. d.	
1	{ 2 lb. Bone meal 1 „ Nitrate of soda }	21.05	25.83	34.76	10,128	863	95.59	19.22	76.37
2	{ 2 lb. Bone meal 1 „ Calcium cyanamide }	25.80	31.49	39.92	11,976	998	109.78	18.81	90.97
3	Control--No manure	21.53	29.16	35.11	10,533	878	96.58	...	96.58
4	{ 2 lb. Basic slag ½ „ Sulphate of potash }	24.65	34.83	32.76	9,828	819	90.09	9.57	80.52
5	{ 2 lb. Basic slag ½ „ Sulphate of potash ½ „ Sulphate of ammonia }	26.25	37.96	30.53	9,159	763	83.93	14.92	69.01
6	{ 1½ lb. Superphosph. of lime ½ „ Sulphate of potash ½ „ Sulphate of ammonia }	26.95	40.51	31.03	9,309	776	85.36	13.62	71.74
7	Control--No manure	21.37	27.43	26.41	7,923	660	72.60	...	72.60
8	{ 1 lb. Bone meal ½ „ Superphosph. of lime ½ „ Sulphate of potash ½ „ Nitrate of soda }	25.45	31.30	28.15	8,445	704	77.44	16.25	61.19
9	Control--No manure	25.68	30.11	31.55	9,465	789	86.79	...	86.79

* Vide Table I.

LA COMPENSACION ESTATE—ARIMA.

The manures were applied at the end of April 1913, but no forking was done except to plots 6 and 12 to which pen manure has been applied. The rainfall registered on the estate for the twelve months from May 1. 1913 to April 30, 1914 was 77.84 inches.

There has been a further increase from all the plots compared with the two previous years, and 2,228 lb. more of dry cacao have been reaped than for the crop of 1911-12. The control plots have given an increase of 3,151 pods as against 4,280 pods per acre for the average of the manured plots. Plots 7, 9, 10, 11 and 12 have given a larger increase than either of the control plots, and it will also be observed that plots 1, 2, 8, 5 and 6 have given a larger increase than control plot 4.

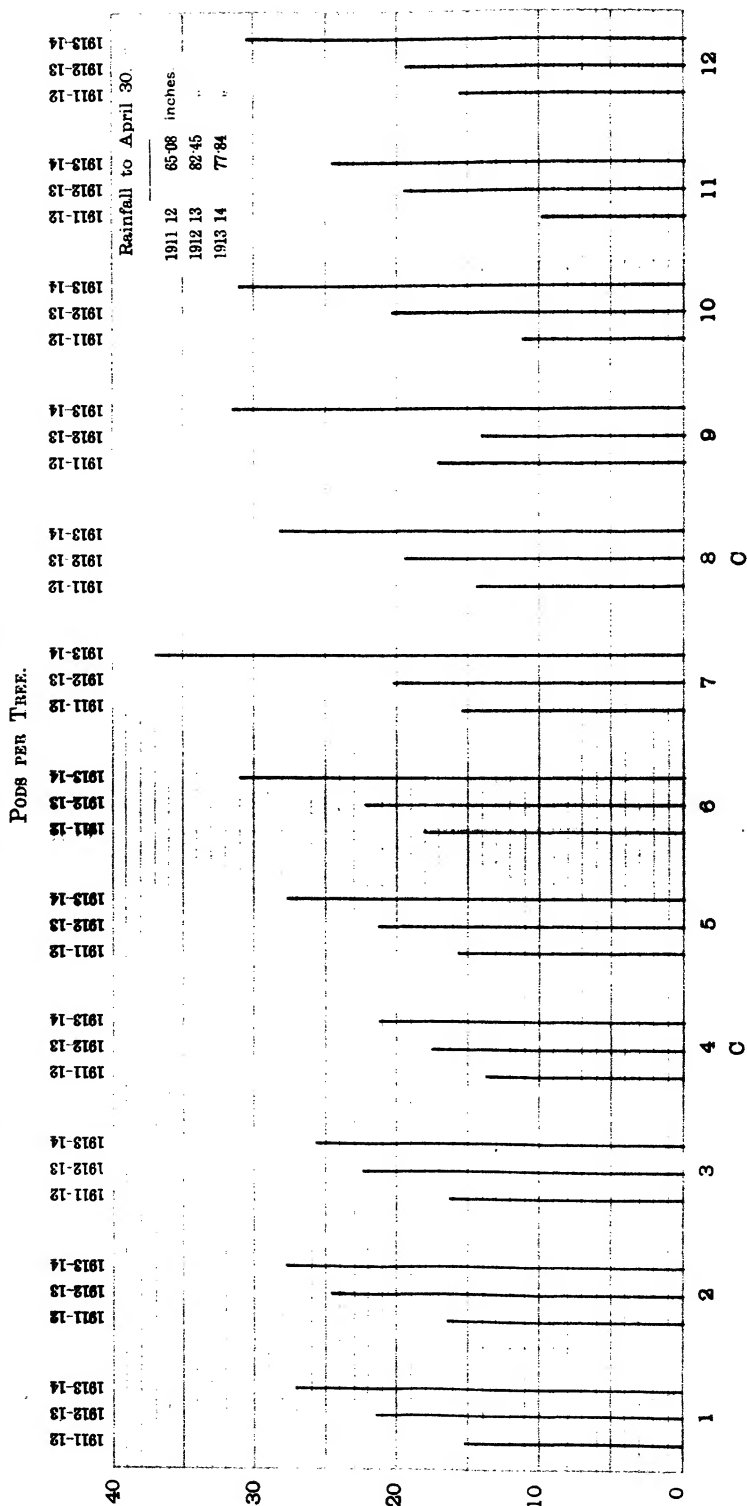
TABLE VI.—MANURIAL EXPERIMENTS—LA COMPENSACION ESTATE.

Trees over 50 years old in 1911.

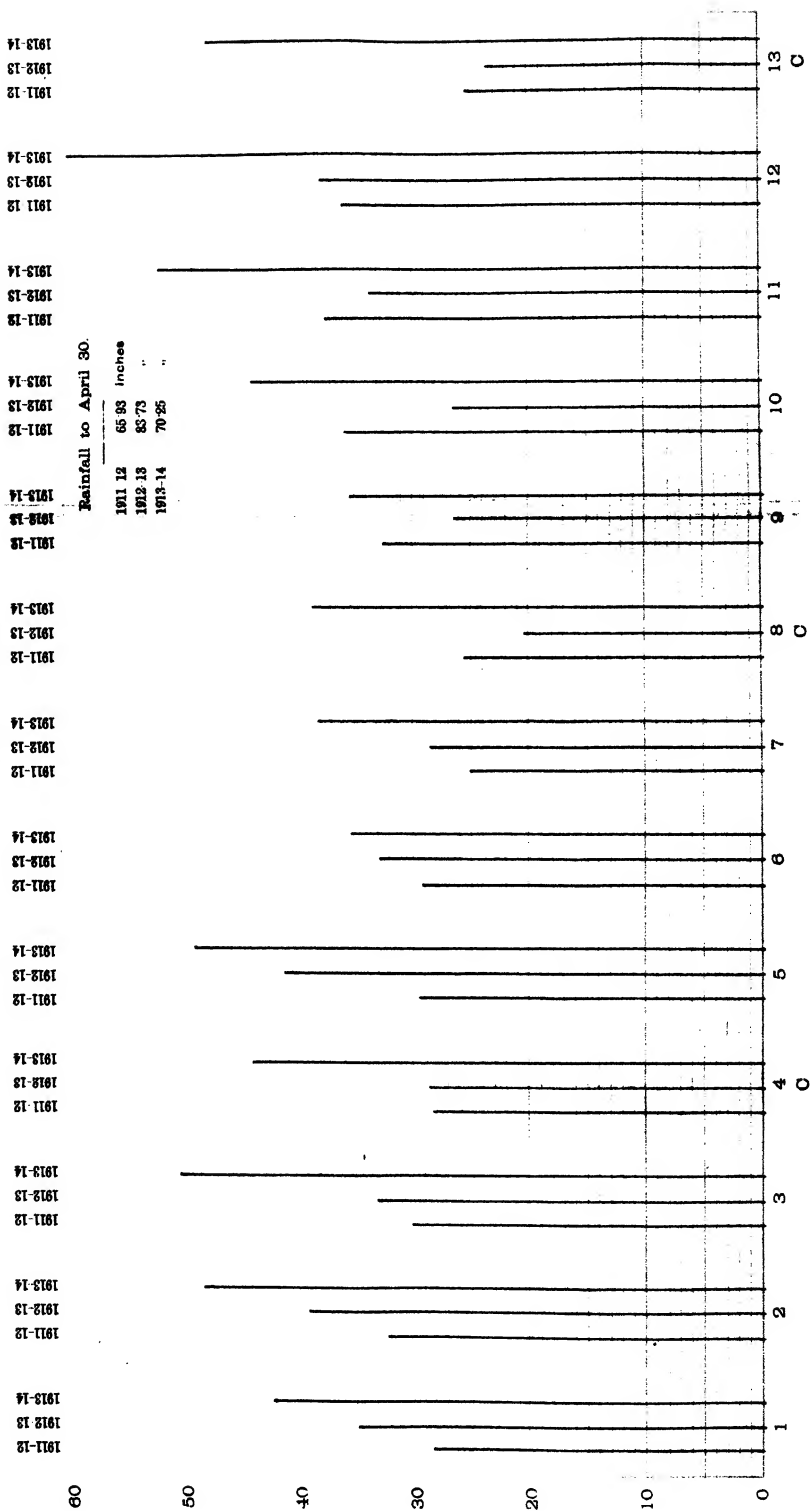
Plot.	Manures applied per tree.	Average number of pods picked per tree 1911-12.	Average number of pods picked per tree 1912-13.	YIELD—SEPT. 1, 1913, TO AUG. 31, 1914.					
				Average number of pods picked per tree.	Per acre of 300 trees.				
					No. of pods picked.	Lb. dry cacao.	Value of dry cacao at 11 cents per lb.	Cost of manuring.	Col. A. less Col. B.
						(A) \$ c.	(B) \$ c.	\$ c.	
1	{ 2 lb. Basic slag 1/2 „ Sulphate of potash }	15.15	21.48	26.99	8,097	675	74.25	9.31	64.94
2	{ 2 lb. Basic slag 1/2 „ Sulphate of potash 1/2 „ Sulphate of ammonia }	16.34	24.48	27.91	8,373	698	76.78	14.41	62.37
3	{ 2 lb. Basic slag 1 „ Nitrate of soda }	16.40	22.29	25.84	7,752	646	71.06	13.97	57.09
4	Control—No manure	13.84	17.62	21.24	6,372	531	58.41	...	58.41
5	{ 2 lb. Bone meal 1/2 „ Sulphate of potash 1/2 „ Sulphate of ammonia }	15.85	21.31	27.85	8,355	696	76.54	16.84	59.72
6	{ 1 lb. Bone meal 1/2 „ Sulphate of potash 1/2 „ Sulph. of ammonia 75 „ Pen manure }	18.10	22.27	31.01	9,303	775	85.25	27.20	57.99
7	{ 1 lb. Superphosph. of lime 1/2 „ Sulphate of potash 1/2 „ Nitrate of soda }	15.64	20.12	37.04	11,112	926	101.86	12.84	89.02
8	Control—No manure	14.46	19.62	28.07	8,421	702	77.22	...	77.22
9	3 lb. Lime ...	17.25	14.18	31.51	9,453	788	80.68	3.72	82.96
10	{ 3 lb. Lime 1 „ Superphosph. of lime }	11.26	20.28	31.07	9,321	777	85.47	7.72	77.75
11	{ 1/2 lb. Sulphate of potash 1/2 „ Sulphate of ammonia }	10.04	19.73	24.72	7,416	618	67.98	9.27	58.71
12	{ 1/2 lb. Sulphate of potash 1/2 „ Sulph. of ammonia 75 „ Pen manure }	15.78	19.64	30.55	9,165	764	84.04	19.80	64.24

* Vide Table I.

Diagram VI.—Comparative yield of plots for three years on La Compensacion Estate.



PODS PER TREE.



SANTA ISABELLA ESTATE—BRASSO.

The manures were applied in March 1913, but it was only possible to obtain 15 lb. pen manure and 20 lb. mulch per tree for plots 6 and 12 respectively. The cost of manuring these plots is also comparatively high owing to the long distance from which the pen manure and the mulch had to be obtained. The rainfall on an adjoining estate from May 1, 1913 to April 30, 1914, was 70.25 inches.

There has been a substantial increase in the yield from all the plots compared with the two previous years but it will be observed that the largest increase was obtained from one of the control plots No. 13, viz.:—an increase of 22.86 and 24.11 pods on crops 1911-12 and 1912-13 respectively, or practically two pounds of dry cacao per tree.

Taken together the plots have given 2,608 lb. more of dry cacao than in 1911-12. There has been an increase of 4,364 pods per acre from the control plots against an increase of 3,558 pods from the average of the manured plots, the only manured plots giving a higher increase than the control plots being 3, 5 and 12.

TABLE VII.—MANURIAL EXPERIMENTS—SANTA ISABELLA ESTATE.

Trees 25 to 30 years old in 1911.

Plot.	Manures applied per tree.	Average number of pods picked per tree 1911-12.	Average number of pods picked per tree 1912-13.	YIELD—SEP. 1, 1913 TO AUG. 31, 1914.					
				Average No. of pods picked per tree.	Per acre of 258 trees.				
					No of pods picked.	Lb. dry cacao.	Value of dry cacao at 11 cents per lb.	Cost of manuring.	Col. A less Col. B.
						(A)	(B)		
1	{ 2 lb. Basic slag " Sulphate of potash }	28.44	35.00	42.58	10,986	915	100.65	9.02	91.63
2	{ 2 lb. Basic slag " Sulphate of potash " Sulph. of ammonia }	32.26	39.06	48.46	12,503	1,042	114.62	13.17	101.45
3	{ 2 lb. Basic slag " Nitrate of soda }	30.13	33.21	50.23	12,959	1,080	118.80	13.12	105.68
4	Control—No manure	28.50	28.92	43.97	11,344	945	103.95	...	103.95
5	{ 2 lb. Bone meal " Sulphate of potash " Sulph. of ammonia }	29.85	41.08	49.01	12,644	1,054	115.94	16.51	99.43
6	{ 1 lb. Bone meal " Sulphate of potash " Sulph. of ammonia " Pen manure }	29.28	32.97	35.48	9,154	763	83.93	21.60	62.33
7	{ 1 lb. Superphosph. of lime " Sulphate of potash " Nitrate of soda }	25.07	28.69	38.16	9,845	820	90.20	12.27	77.93
8	Control—No manure	25.84	20.55	38.76	10,000	833	91.63	...	91.63
9	3 lb. Lime ...	32.70	26.59	35.73	9,211	768	84.48	4.90	79.58
10	{ 3 lb. Lime " Superphosph. of lime }	33.97	26.63	44.00	11,332	946	104.06	9.46	94.60
11	{ 1 lb. Sulphate of potash " Sulph. of ammonia }	37.58	33.92	51.98	13,411	1,117	122.87	8.57	114.30
12	{ 1 lb. Sulphate of potash " Sulph. of ammonia " Mulch ... }	30.18	38.02	59.74	15,413	1,284	141.24	15.06	126.18
13	Control—No manure	25.63	23.78	47.89	12,356	1,030	113.30	...	113.30

* Vide Table I.

SOCONUSCO ESTATE—SANTA CRUZ.

The artificial manures were applied in April, the mulch and pen manure in June 1913, and 62·86 inches of rain were registered in the district for the twelve months ending April 30, 1914.

Plots 2, 3, 5, 6, 7, 11 and 13 have given an appreciable increase over crop 1911-12, but control plot 8 shows a decrease whereas only a slight increase has been obtained from control plot 4. On the whole 52 lb. less of dry cacao has been reaped during the year but 1,065 pods less per acre have been obtained from the control plots whereas the average of the manured plots has given 637 pods more per acre than in 1911-12.

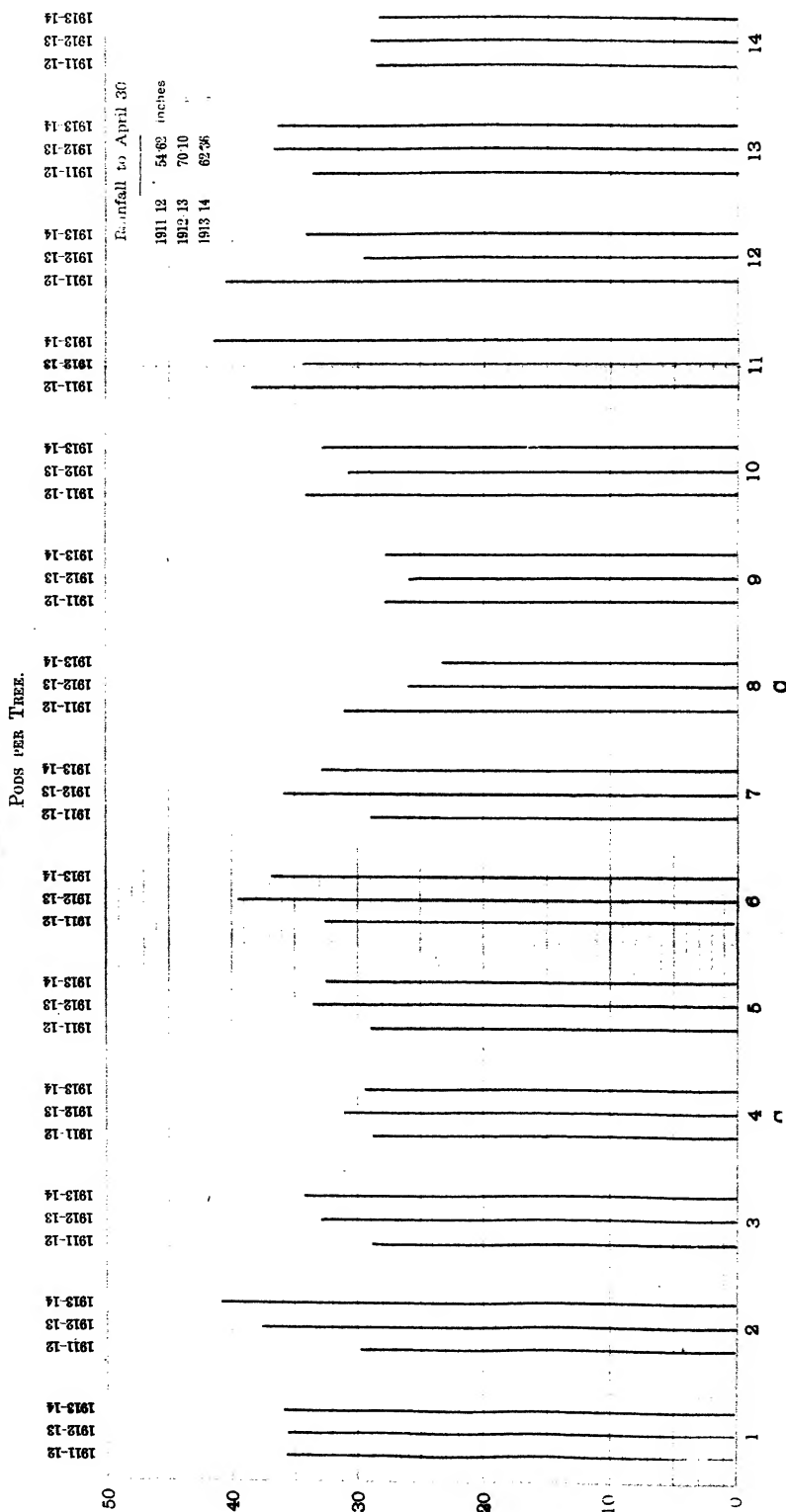
TABLE VIII.—MANURIAL EXPERIMENTS—SOCONUSCO ESTATE.

Trees over 50 years old in 1911.

Plot.	Manures applied per tree.	Average number of pods picked per tree 1911-12.	Average number of pods picked per tree 1912-13.	YIELD—SEP. 1, 1913 TO AUG. 31, 1914.					
				Average No. of pods picked per tree.	Per acre of 300 trees.				
					No. of pods picked.	Lb. dry cacao.	Value of dry cacao at 11 cents per lb.	Cost of manuring.	Col. A less Col. B.
1	{ 2 lb. Basic slag ½ „ Sulphate of potash }	35·40	35·20	35·57	10,671	889	(A) 97·79	(B) 10·89	\$ c. 86·90
2	{ 2 lb. Basic slag ½ „ Sulphate of potash ½ „ Sulph. of ammonia }	29·66	37·28	40·37	12,111	1009	110·99	17·59	93·40
3	{ 2 lb. Basic slag 1 „ Nitrate of soda }	28·57	32·67	34·03	10,209	851	93·61	15·55	78·06
4	Control—No manure	28·56	30·89	29·12	8,736	728	80·08	...	80·08
5	{ 2 lb. Bone meal ½ „ Sulphate of potash ¼ „ Sulph. of ammonia }	28·77	33·10	32·15	9,645	804	88·44	18·43	70·01
6	{ 1 lb. Bone meal ½ „ Sulphate of potash ½ „ Sulph. of ammonia 75 „ Pen manure }	32·53	39·41	36·60	10,980	915	100·65	52·34	68·31
7	{ 1 lb. Superphosp. of lime ½ „ Sulphate of potash ½ „ Nitrate of soda }	28·89	35·37	32·55	9,765	814	89·54	14·43	75·11
8	Control—No manure	30·81	25·83	23·15	6,945	579	63·69	...	63·69
9	3 lb. Lime ...	27·84	25·88	27·82	8,346	695	76·45	5·80	70·65
10	{ 3 lb. lime 1 „ Superphosph. of lime }	34·02	30·56	32·79	9,837	820	90·20	11·81	78·39
11	{ ½ lb. Sulphate of potash ½ „ Sulph. of ammonia }	38·19	34·12	41·08	12,324	1027	112·97	10·85	102·12
12	{ ½ lb. Sulphate of potash ½ „ Sulph. of ammonia 75 „ Pen manure }	40·27	29·54	33·98	10,194	849	93·39	30·30	63·09
13	40 to 50 lb. Mulch ...	33·32	36·55	36·15	10,845	904	99·44	31·24	68·20
14	50 lb. Pen manure ...	28·50	28·98	28·35	8,505	709	77·99	10·93	67·06

¹ Vide Table I.

Diagram VIII.—Comparative yield of plots for three years on Soconusco Estate.



PODS PER POUND OF DRY CACAO.

A record of the figures required for ascertaining the number of pods necessary to produce a pound of dry cacao has again been kept during the year and with those for the two previous years is given below.

TABLE IX.

ESTATE.	TOTAL NUMBER OF PODS PICKED.			LB. DRY CACAO.			NO. OF PODS PER LB. DRY CACAO.		
	1911-12.	1912-13.	1913-14.	1911-12.	1912-13.	1913-14.	1911-12.	1912-13.	1913-14.
Santa Marta ...	10,312	11,901	28,785	834	1,086	2,283	12.36	10.96	12.61
Esperanza ...	23,668	15,097	23,070	1,812	1,148	1,833	13.06	13.15	12.5
New Grant ...	29,342	25,769	37,429	2,259	2,068	2,395	12.99	12.46	15.63
Perseverance ...	35,826	46,151	45,494	1,901	3,269	3,512	18.84	14.12	12.95
La Compensacion ...	26,184	35,375	49,052	2,051	3,208	4,277	12.75	11.03	11.47
Santa Isabella ...	48,961	51,320	74,052	4,475	5,088	7,083	10.94	10.09	10.45
Soconusco ...	58,337	57,930	58,213	4,172	3,975	4,129	13.98	14.57	14.13
River ...	35,596	46,137	56,294	2,779	3,839	4,710	12.81	12.02	11.95
Brooklyn ...	68,261	80,098	92,141	5,520	7,363	8,185	12.37	10.86	11.26

Apart from the increase at New Grant and the further decrease on the Perseverance estate the number of pods required to produce a pound of dry cacao on several of the estates in 1913-14 is approximately the same as the average of the two previous years.

NATURAL YIELD OF PLOTS.

The results obtained from the *natural yield* plots for the two years to August 31, 1914, are recorded in Table X.

TABLE X.—NATURAL YIELD OF PLOTS.

	LA RETRAITE ESTATE, PRINCES TOWN. Trees 20 to 22 years old in 1912.	LA COMPENSA- CION ESTATE, ARIMA. Trees over 50 years old in 1912.	EVARDALE ESTATE, UNAPO. Trees 18 to 19 years old in 1912.	SANTA MARTA ESTATE, TAMANA. Trees 22 to 25 years old in 1912.	SOCONUSCO ESTATE, SANTA CRUZ. Trees over 50 years old in 1912.	PERSEVERANCE ESTATE, TUPAPO Trees 40 to 45 years old in 1912.	EL SALVADOR ESTATE, MONTERRAT. Trees 35 to 40 years old in 1912.	KONBOROUGH ESTATE, TOBAGO. Trees 9 years old in 1912.	
	Average number of pods picked per tree.	Average number of pods picked per tree.	Average number of pods picked per tree.	Average number of pods picked per tree.	Average number of pods picked per tree.	Average number of pods picked per tree.	Average number of pods picked per tree.	Average number of lbs. wet cacao picked per acre.	
Rain- fall.	1912-13. 76.98 in.	1912-13. 82.45 in.	1912-13. 77.84 in.	1912-13. 89.32 in.	1912-13. 70.10 in.	1912-13. 77.61 in.	1912-13. 72.49 in.	1912-13. 76.69 in.	
Plot.	16.33 13.99 11.41 14.14 11.87 11.64 11.21 22.44 20.89 11.53 26.91 31.36 24.69 31.21 31.21 28.60 8.52 9.32 9.67 9.64 12.46 10.22 12.12	26.78 32.40 26.66 28.54 26.18 22.01 22.58 40.71 35.30 26.91 31.36 32.77 42.26 44.46 17.38 20.73 14.93 18.31 25.70 29.80 22.96 24.04	29.97 18.69 23.43 23.43 21.26 17.55 2.46 23.43 18.47 22.57 15.40 21.82 17.97 24.89 25.33 37.67 34.63 32.53 30.43 33.94 37.96 26.28 22.22	19.26 13.43 12.94 16.16 24.63 20.01 22.07 22.96 18.62 22.56 22.90 31.21 34.08 20.71 20.15 18.47 18.51 21.20 20.08 19.95 23.34 23.18 26.94 27.84 19.00 29.84 29.85 26.93 26.43	25.44 30.29 30.02 29.70 33.53 35.27 33.69 31.91 27.31 46.91 35.62 39.99 48.11 38.97 29.66 19.44 21.08 20.08 23.36 23.36 23.34 34.69 27.84 19.00 29.84 29.85 26.93 26.43	40.72 37.20 39.31 29.22 25.33 37.70 33.30 39.41 49.20 46.91 35.62 39.99 48.11 38.97 29.66 31.76 30.19 23.36 23.36 23.34 34.69 27.84 19.00 29.84 29.85 26.93 26.43	42.08 45.48 53.28 48.21 55.93 41.68 39.73 46.07 44.85 36.68 38.71 42.50 38.17 38.97 36.35 36.46 41.61 40.90 45.19 34.41 35.91 38.19 38.55 43.50 38.72 35.81	46.91 52.60 54.60 53.86 57.58 44.63 46.07 38.71 44.85 36.68 38.71 42.50 38.17 38.97 36.35 36.46 41.61 40.90 45.19 34.41 35.91 38.19 38.55 43.50 38.72 35.81	+ 1.940 1.332 1.210 1.116 1.305 1.183 1.371 1.349 1.229 1.836 1.317 1.002 1.241 1.171 1.132 1.485 1.638 1.890 2.144 2.159 2.159 2.253 1.989 1.762 1.815 1.409 1.568 1.646 1.430

† Records for eight months from January to August, 1913.

* Vide Table I.

From the figures recorded in this table it will be seen that the yield obtained on the different estates does not show any uniform variation.

1. All the plots on the La Retraite and Evasdale estates have given an increased yield, and it will be observed that the yield from several of the plots is double that of the previous year.

2. With the exception of one plot at Santa Marta and El Salvador and three plots at La Compensacion, all of the other plots on these estates show an increase in yield. It should also be pointed out that two plots at Santa Marta and four plots at La Compensacion have doubled the previous year's yield.

3. On the Soconusco and Roxborough estates, 9 and 15 plots respectively show a decrease whereas on the Perseverance estate none of the plots have given an increase on the previous year. With regard to the Perseverance estate, it may be mentioned that the plots were drained in 1913, and it has generally been observed that drainage has a tendency to reduce the crop of the following year, on the heavy clay soils of this estate.

The increase or decrease in the crop of each plot compared with the previous year is shown in Table XI. A minus sign (—) indicates a decrease; the figures without any sign in front indicate increases. The results are stated as pods picked per tree, except for the Roxborough estate where they are given in pounds wet cacao per acre.

TABLE XI.—NATURAL YIELD OF PLOTS, SHOWING THE INCREASE OR DECREASE OF CROP 1913-14 ON CROP 1912-13.

Plot.	LA RETRAITE ESTATE.	LA COMPENSA- CION ESTATE.	EVASDALE ESTATE.	SANTA MARTA ESTATE.	SOCONUSCO ESTATE.	PERSEVERANCE ESTATE.	EL SALVADOR ESTATE.	ROXBOROUGH ESTATE.
	Increase or decrease on crop 1912-13.	Increase or decrease on crop 1912-13.	Increase or decrease on crop 1912-13.	Increase or decrease on crop 1912-13.	Increase or decrease on crop 1912-13.	Increase or decrease on crop 1912-13.	Increase or decrease on crop 1912-13.	Increase or decrease on crop 1912-13.
Pods per tree.								
	*	*	*	*	*	*	*	Lb. wet cacao per acre.
1	10.45	8.10	14.99	13.31	-0.56	-17.47	4.83	-231
2	18.41	4.29	7.90	13.30	-3.85	-0.43	7.12	66
3	15.25	2.44	14.87	18.79	0.92	-3.15	1.32	94
4	14.40	2.19	14.23	10.50	3.83	-3.89	5.65	-122
5	14.31	-3.92	20.46	4.94	-1.04	-0.63	1.65	-153
6	10.47	-1.37	11.17	9.68	0.54	-2.11	2.33	-153
7	11.37	1.89	12.72	2.22	-1.34	-0.18	6.34	61
8	18.27	-1.53	12.08	7.67	-0.16	1.92	2.90	85
9	14.91	7.76	10.80	5.42	1.30	-11.29	2.03	-440
10	16.38	2.67	23.05	8.31	1.40	-15.51	2.29	-225
11	14.33	0.84	17.41	17.86	2.90	-9.94	2.25	70
12	8.08	10.70	15.37	8.69	2.51	-7.23	8.72	58
13	11.05	9.38	17.66	9.60	0.97	-4.82	6.64	30
14	15.86	19.94	1.85	7.02	2.57	-11.31	3.54	-158
15	8.86	19.26	15.17	11.06	-1.12	-7.85	2.44	2
16	11.21	17.59	13.35	10.18	-3.35	-6.17	4.29	-378
17	8.64	16.04	8.57	9.01	-1.52	-13.04	1.50	-417
18	16.06	12.40	15.56	8.16	2.01	-11.37	0.36	-266
19	17.34	18.75	14.64	-1.18	0.21	-9.70	-1.05	144
20	12.74	9.83	17.34	2.05	No record	-3.52	3.92	27
21	11.72	7.70	21.68	1.81	No record	-2.11	8.35	81
22	...	...	...	...	-2.35	...	...	153
23	...	...	...	...	...	...	...	243
24	...	...	...	...	...	...	...	154

* Dividing the figures in these columns by 2 gives approximately number of bags (166 lb.) dry cacao per 1,000 trees.

The results recorded in Tables X and XI, have been obtained without the application of any manures whatever, and as far as each estate is concerned the cultivation of the plots has been identical. The difference therefore between the yield of one crop and another is undoubtedly due to seasons, to cultural operations, as pointed out in the case of the Perseverance estate, and also to the increasing age of the trees, when these have not yet attained their full bearing capacity, although the increase in yield from this latter cause may not be very marked from one year to the next. It will be seen that the largest increases over crop 1912-13 were obtained on the Evasdale and La Retraite plots respectively.

The variation in the yield between the various plots on each estate for the same crop, as pointed out in last year's report, is due to the relative productiveness of the particular group of trees forming each plot, and is largely dependent on the relative proportion of heavy and poor bearing trees thereon. It will be observed that these differences are not uniform, that is, the plots do not increase or decrease in the same proportion from one year to another.

These facts further tend to prove the statement made in my report for last year viz:—that in order to be able to arrive more readily at reliable conclusions, as to the relative values of different manures applied to cacao trees, it is necessary to ascertain the natural yield of the plots over a series of years, previous to the application of the manures.

It is interesting to note the difference between the highest and lowest yielding plots on each estate. The figures recorded for the two years are shown in Table XII.

TABLE XII.—NATURAL YIELD OF PLOTS.

	LA RETRAITE ESTATE.		LA COMPENSA- CION ESTAT.		EVASDALE ESTATE.		SANTA MARTA ESTATE.		SUCUNTSO ESTATE.		PRSEVERANCE ESTATE.		EL SALVADOR ESTATE.		ROXBOROUGH ESTATE.	
	1912-13.	1913-14.	Average No. of pods picked per tree.	1912-13.	1913-14.	Average No. of pods picked per tree.	1912-13.	1913-14.	Average No. of pods picked per tree.	1912-13.	1913-14.	Average No. of pods picked per tree.	1912-13.	1913-14.	Average No. of pods picked per tree.	1912-13.
Highest	31.21	44.46	23.83	27.96	30.65	44.65	27.00	34.08	35.27	36.93	54.50	47.28	55.93	57.58	9.255	1,989
Lowest	8.52	17.38	14.19	17.55	14.04	23.03	12.94	19.52	18.47	19.44	18.67	9.30	30.60	35.91	1,132	1,074
Difference	22.69	27.08	9.64	20.41	16.61	21.62	14.06	14.56	16.80	17.49	35.83	37.98	25.33	21.67	1,123	915

It is evident from these figures that it would be absolutely erroneous to consider any one plot as a control for any series of plots.

The cacao reaped from the *natural yield* plots has been cured, dried and weighed separately with the object of further ascertaining the number of pods required to produce a pound of dry cacao.

The results obtained for the two years are recorded in Table XIII.

TABLE XIII.

NAME OF ESTATE.	TOTAL NUMBER OF PODS PICKED.		LB. DRY CACAO.		NO. OF PODS PER LB. DRY CACAO.	
	1912-13.	1913-14.	1912-13.	1913-14.	1912-13.	1913-14.
La Retraite...	30,797	57,498	2,095	3,873	14.70	14.84
La Compensacion	37,364	53,028	3,281	4,674	11.39	11.34
Evasdale ...	39,459	70,856	3,391	6,377	11.64	11.11
Santa Marta	41,031	60,834	3,698	4,946	11.91	12.30
Soconusco ..	59,515	66,530	4,200	4,696	14.17	14.17
Perseverance	71,406	56,600	4,761	4,346	15.00	13.02
El Salvador...	83,765	90,876	7,118	7,723	11.77	11.77

NETT WEIGHT OF BAGS OF CACAO OF DIFFERENT COUNTRIES.

	Cwt.
Surinam	2
British West Indies	1½ to 2
Guayaquil	1½
Costa Rica	1½ to 1½
Carupano, Sanchez and Samana	1 to 1½
Java	1 to 1½
Bahia	1½
Ceylon	¾ to 1½
Columbia	
Caracas	
St. Domingo	1
African	
Venezuelan and Puerto Cabello	

SUGAR.

SUGAR PRODUCTION IN JAVA.

THE wonderful advance made in sugar production in Java during the last 20 years is well shown in the following table which has been compiled from data given by Mr. Prinsen Geerligs in the *International Sugar Journal*:—

Year.			Acreage canes harvested.	Production of Sugar per acre.	Total production.
				Lb.	Tons.
1893	...	...	128,500	6,879	472,106
1894	...	...	192,600	6,299	522,601
1895	...	...	190,500	6,747	574,378
1896	...	...	182,800	6,467	525,974
1897	...	...	186,000	6,848	577,057
1898	...	...	198,500	7,999	713,612
1899	...	...	206,100	8,074	750,440
1900	...	...	224,300	7,380	732,525
1901	...	...	250,800	6,998	791,073
1902	...	...	257,400	7,714	873,160
1903	...	...	251,400	8,102	929,919
1904	...	...	254,600	9,090	1,037,936
1905	...	...	260,500	8,799	1,022,813
1906	...	...	273,600	8,138	1,050,982
1907	...	...	280,300	9,347	1,191,063
1908	...	...	290,600	9,426	1,222,323
1909	...	...	301,700	9,074	1,227,618
1910	...	...	312,600	9,084	1,258,287
1911	...	...	335,600	9,686	1,443,465
1912	...	...	346,800	8,960	1,384,242
1913	...	...	359,200	9,009	1,442,884

Comparing 1893 with 1913 it will be seen that the area of canes harvested has increased from 128,500 to 359,200 acres, and the production of sugar from 472,106 tons to 1,442,884 tons.

Even more striking are the figures relating to the yield of sugar per acre. The average per acre during the first five years of the period under review was 2 tons, 17 cwt. whilst during the last five years it has risen to 4 tons $1\frac{1}{2}$ cwt.

In Java sugar cane is cultivated under very different conditions from those prevailing in the West Indies. As pointed out in *The World's Cane Sugar Industry* (1912) also by Prinsen Geerligs "the planting is done exclusively on irrigated land, and a triennial rotation of crops is practised. In some parts where the soil is scarce, one meets with a two year rotation, and in other places a four year is met with ; but a triennial one is the rule and in every case cane is planted after a rice crop. . . . The following scheme approximately indicates the succession of crops although it is not an exclusive example. Sometimes tapioca [cassava] or some other crop is planted instead of rice so that then only one rice crop finds its place between two cane harvests :—

September ...	...	... Cane crops.
September to November ...	...	... Beans, Maize, &c.
November to April ...	...	... Rice.
April to November ...	...	... Fallow, beans, indigo, &c.
November to April ...	...	... Rice.
April to September of next year	...	... Cane, &c."

The increase in yield of sugar per acre Mr. Geerligs attributes to "improved varieties of cane, rational treatment, and manuring of the fields, and extremely punctilious superintendence."

"The manufacture" he adds has also "attained to great perfection, and may serve as an example of a well managed and well controlled business, the ample investment of funds in the newest machinery, the activity of the sugar experiment stations, the adequate training of sugar chemists and factory chiefs,—all these have combined towards making the Java sugar industry a model one, of which it may rightly be proud."

OILS AND OIL SEEDS.

NEW MARKETS FOR COPRA FROM BRITISH COLONIES AND INDIA.

A TECHNICAL Information Bureau has recently been founded at the Imperial Institute, London, with the object of assisting producers in British Colonies and in India in getting into touch with manufacturers in the United Kingdom and thus finding new outlets for products which owing to the war have been diverted from their customary channels. A good example is afforded in copra, which formerly was largely consumed in Germany and Austria-Hungary markets which are now closed. In order to forward this work the Bureau proposes to issue summaries respecting such products, and the following regarding copra has recently been published. In response to a request the department has supplied the Imperial Institute with a list of the chief copra exporters of this Colony.

"Large quantities of copra have been exported during recent years from British Possessions to Germany and Austria-Hungary, and as this trade has totally ceased owing to the war it is necessary to consider the question of finding other markets for the produce.

"The following table shows the imports of copra into Hamburg and Austria-Hungary during 1913, and will give some indication of the extent of the total trade and of the share of British Possessions. Hamburg is the chief centre of the German oil-seed crushing industry, and it is probable that the shipments of copra to that port practically represent the total German imports.

IMPORTS OF COPRA IN 1913 TO HAMBURG AND AUSTRIA-HUNGARY.

		Quantity Metric tons. (2,204 lb.)
<i>Hamburg</i>		
Imports from all sources ...	...	230,895
" British Possessions	...	124,484
<i>Austria-Hungary</i>		
Imports from all sources ...	...	83,604
" British Possessions	...	29,177

The details of the imports from the British Empire are as follows:—

FROM THE BRITISH EMPIRE.

	<i>Hamburg</i> Metric tons (2,204 lb.)	<i>Austria-Hungary</i> Metric tons (2,204 lb.)
United Kingdom ...	225	...
British, Central and South America...	195	...
British Africa ...	(not given)	774
British East Indies ...	112,341	22,104
Australia ...	10,653	6,299
British South Sea Islands ...	1,020	
	<hr/> 124,484 <hr/>	<hr/> 29,177 <hr/>

"These figures are not quite accurate and complete. Some imports from British West Africa reach Hamburg but are not separately shown in the returns for that port. The imports from Australia to Austria-Hungary includes 608 metric tons from British Australia and 5,691 metric tons described merely as from Australia, which may include some of the foreign possessions in the Pacific. The figures are however probably sufficiently accurate for the present purpose.

"The quantity of British copra for which a new market must be found may therefore be taken as about 153,611 metric tons.

"It seems likely that a considerable proportion of this can be taken by the United Kingdom. The copra imported into Germany and Austria-Hungary is used for the production of oil (coconut oil) and feeding cake (coconut cake). The quantity of coconut oil exported from Hamburg in 1913 amounted to 40,966 metric tons of which 30,236 was sent to the United Kingdom and 5,261 metric tons to Norway and Sweden, the next largest purchasers. Copra is already expressed for oil in the United Kingdom and coconut oil is made both in Ceylon and India. There appears to be no reason therefore why the coconut oil which is imported to the United Kingdom from Hamburg should come in this roundabout way. The oil might be expressed in Ceylon or India and shipped direct to the United Kingdom or the copra might be exported to the United Kingdom and treated here instead of in Hamburg.

"Further, the Trade Returns for the United Kingdom show that in 1913 this country also imported about 18,600 metric tons of coconut oil from foreign countries other than Germany. The total imports of foreign coconut oil to the United Kingdom in 1913 therefore amounted to about 49,000 metric tons, corresponding to about 82,000 tons of copra.

"It is moreover certain that from all these foreign countries which export coconut oil to the United Kingdom, and especially from Germany, considerable quantities of coconut oil also reach this country in the form of margarine, vegetable butter and prepared fats and foods of various kinds. No definite figures can be suggested for the amount received in this way.

"It is clear from the foregoing statement that considerably more than half of the British copra hitherto exported to Germany and Austria-Hungary could be taken by the United Kingdom, either in the form of copra or coconut oil. Ceylon and India produce both copra and coconut oil so that these countries could probably divert their supplies in either form to the United Kingdom.

"In addition to the possibility of finding a market in the United Kingdom there appears to be a considerable chance of the British Possessions securing a share of the French import trade in copra. In 1912 the total imports of copra into France was 153,506 metric tons. Of this total 19,691 metric tons came from British Possessions, and 10,321 metric tons from French Colonies. Of the remainder 43,422 metric tons came from the Dutch East Indies and 72,964 metric tons came from the Philippines. It ought to be possible for Ceylon, India, and the Federated Malay States to compete on favourable terms with the Dutch East Indies and the Philippines for this trade. There also seem to be considerable possibilities of developing an export trade in copra with Denmark, Scandinavia and Russia, and possibly with Holland.

"In the case of the United States the imports of copra in 1913 amounted to 15,548 metric tons of which 10,674 metric tons came from the Philippines and the rest mainly from French, British and German Possessions in the Pacific. The imports of coconut oil to the United States amounted in 1913 to 22,915 metric tons of which about 18,000 metric tons came from Ceylon, India, the United Kingdom and Australia, and the rest chiefly from France, Germany and the Philippines."

As regards Trinidad and Tobago the bulk of the coconuts exported are sent as nuts to the United States and Canada. The quantity of copra exported has varied considerably during recent years, being 1,662,114 lb. in 1911; 3,160,210 lb. in 1912; 1,154,539 lb. in 1913 and 2,358,154 lb. in 1914. The value of copra sent to Germany in 1911, 1912 and 1913 amounted to £17,348, out of a total of £353,515. The exports of coconut oil from the Colony are negligible, the output of the factories being almost entirely consumed locally. Should however the price for coconuts continue low, it will probably be better for those estates which are equipped for the purpose to devote greater attention to the preparation of copra and coconut oil for the export trade.

AGRICULTURAL LEGISLATION.

AGRICULTURAL EXPORT TAXES, 1915.

In addition to the usual export taxes on agricultural products levied in order to raise funds in aid of Immigration, and for the purposes of the Board of Agriculture, it has been enacted by Ordinance 49 of 1914 that a special tax shall be levied during 1915 in order to raise "certain emergency funds required in view of local conditions consequent on the present war." The rates of taxation for these several funds are summarised in the following table :—

	Immigra- tion Fund.	Agri- cultural Fund.	Emer- gency Funds.	Total.
	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Sugar: <i>per 1,000 lb.</i> ...	1 6	1½	8 0	4 7½
Molasses: <i>per 100 galls.</i> ...	1 0	Nil	Nil	1 0
Rum and Bitters; <i>per 100 galls.</i> ...	2 10	Nil	Nil	2 10
Cacao: <i>per 100 lb.</i> ...	1½	¾	2½	4½
Coffee: <i>per 100 lb.</i> ...	4	Nil	Nil	4
Coconuts: <i>per 1,000 nuts</i> ...	4	1½	1 6	1 11½
Copra: <i>per 1,000 lb.</i> ...	1 3	2½	5 0	6 5½

LICENSING OF VEHICLES.

THE following are the prescribed licenses and the duties payable in respect thereof under the Licensing of Vehicles Ordinance, No. 40 of 1914.

	Per Annum.	Per Quarter.
	<i>£ s. d.</i>	<i>£ s. d.</i>
Carriages (other than a Hackney Carriage) <i>per wheel</i> ...	5 0	1 6
Hackney Carriage ...	1 5 0	7 6
Motor Car, not exceeding 1,600 lb. in weight...	2 0 0	12 0
„ exceeding 1,600 lb., but not exceed- ing 2,600 lb. in weight ...	8 10 0	1 1 0
„ exceeding 2,600 lb., but not exceed- ing 3,600 lb. in weight ...	6 10 0	1 19 0
„ exceeding 3,600 lb. in weight ...	10 0 0	2 15 0
Motor Cab, not exceeding 1,600 lb., in weight	8 5 0	19 6
„ exceeding 1,600 lb., but not ex- ceeding 2,600 lb. in weight ...	4 15 0	1 8 6
„ exceeding 2,600 lb., but not ex- ceeding 3,600 lb. in weight ...	7 15 0	2 6 6
„ exceeding 3,600 lb. in weight ...	11 5 0	8 2 6
Motor Cycle ...	1 0 0	6 0
Motor Van or Lorry ...	10 0 0	2 15 0
Motor Omnibus ...	10 0 0	2 15 0
Tram Car ...	10 0 0	2 15 0
Hand Cart ...	12 6	8 9
Cart drawn by one donkey ...	15 0	4 6
Agricultural Cart ...	1 5 0	7 6
Cart (other than hand cart or cart drawn by one donkey, or Agricultural Cart) ...	2 10 0	15 0
Bicycle or Tricycle ...	5 0	1 6

NOTES.

On January 20 the Board of Agriculture met at San Fernando and subsequently visited the cassava cultivation and the experimental cassava factory erected at Palmiste Estate. In the afternoon a public meeting in connection with the Naparima District Agricultural Society was held at San Fernando, at which the cultivation and commercial possibilities of cassava were discussed. A full account of the proceedings will appear in the next issue.

The Colony has recently had a visit from Mr. J. L. Fonda on behalf of the Cotton Fine Spinners Association, who is studying the conditions for cotton production throughout the West Indies. Mr. Fonda visited representative localities in Trinidad and Tobago.

Mr. J. C. Augustus, Curator of the Botanic Gardens completed a tour in Tobago during which he visited many of the chief cacao estates, and also addressed a meeting of the Tobago Planters' Association.

Mr. W. E. Broadway has been engaged recently in work under the Plant Protection Ordinance, at Tamana, Cedros and Icacos. He has also given a practical demonstration on budding cacao and other plants to the Savana Grande District Agricultural Society.

The thirty-second annual sale of surplus stock takes place at the Government Farm, Trinidad, on Friday, February 19.

Whilst this *Bulletin* was in the press an editorial appeared in the *Port-of-Spain Gazette* of January 28, 1915 in which it is claimed that the results given in the article on the "Natural yield of Individual Cacao trees" (*Bulletin, Department of Agriculture, Trinidad and Tobago*, XIII, Dec. 1914, pp. 312-19) support the theory that it is advisable to allow all the chupons * on cacao trees to grow.

It should be pointed out that this was not the purpose of the article in which it was stated that "the all chupon plot has been selected because no pruning is done on it The results for any other hundred trees of the same age would be approximately the same."

An account of the results obtained from the series of experiments in progress to test the comparative value of allowing none, one, two, three or all chupons to grow will appear shortly.

Whilst it is premature to draw definite conclusions at the present stage, the results for four years do not support the view that all chupons are to be preferred, and the department is not to be regarded as advocating "all chupons."

* Chupons are the shoots springing from the trunk known in other countries as "suckers," "gormandisers," "water shoots," &c. They are commonly used as "renewals."

METEOROLOGY.

RAINFALL RETURN FROM JANUARY TO DEC. 1914.

Stations.	December, 1914.	December, 1913.	Jan., to Dec., 1914.	Jan., to Dec., 1913.
<i>North-west District.</i>				
	Ins.	Ins.	Ins.	Ins.
St. Clair—Royal Botanic Gardens ...	5.58	1.82	54.12	39.53
Port-of-Spain—Colonial Hospital ...	5.03	1.70	41.53	30.65
" Royal Gaol ...	5.80	2.02	46.37	36.84
" Constabulary Hdqrs. ...	3.17	1.33	38.23	32.97
St. Ann's—Reservoir ...	4.73	1.99	56.01	50.70
Maraval— ...	4.30	2.35	56.54	58.94
" Constabulary Station ...	5.73	2.42	64.98	67.48
Diego Martin—Constabulary Station... ..	5.32	4.09	58.96	64.02
" Waterworks ...	4.81	4.05	58.62	62.57
" River estate ...	4.80	4.00	57.76	65.77
Fort George Signal Station ...	5.58	1.57	61.55	46.64
North Post ...	3.55	3.92	51.13	53.86
Carenage Constabulary Station ...	7.67	1.45	76.00	50.17
Carrera Island Convict Depot ...	4.60	1.32	49.53	38.96
Chacachacare Lighthouse ...	5.69	0.88	42.24	34.99
<i>Santa Cruz—Maracas District.</i>				
Santa Cruz—Constabulary Station ...	3.23	3.53	60.89	67.08
St. Joseph—Government Farm ...	7.56	3.71	52.69	46.72
" Constabulary Station ...	5.55	4.16	44.73	50.16
Tunapuna—St. Augustine estate ...	7.44	3.85	50.56	52.85
Maracas—Government School ...	5.11	5.40	61.39	64.13
" Ortinsula estate ...	6.26	4.62	57.16	57.01
Caura—Wardour estate ...	6.60	5.34	54.92	53.48
<i>West Central District.</i>				
Caroni—Frederick estate ...	9.06	9.22	102.09	124.83
Chaguana—Constabulary Station ...	8.77	5.92	52.67	65.64
" Woodford Lodge estate ...	8.32	5.21	54.14	64.95
Carapichaima—Waterloo estate ...	5.69	5.70	46.50	57.93
" Friendship Hall estate ...	7.75	9.30	52.41	72.30
Couva—Exchange estate ...	5.02	5.11	43.90	49.14
" Brechtin Castle estate ...	6.00	4.76	51.13	57.52
" Perseverance " ...	5.93	6.76	54.38	55.03
" Camden " ...	5.98	5.34	43.97	52.75
" Milton " ...	6.83	6.43	52.97	56.72
" Spring " ...	8.05	6.86	51.50	60.44
" Constabulary Station ...	6.02	5.41	50.91	53.48
" Esperanza estate, Savonetta... ..	5.05	5.50	47.08	52.00
<i>San Fernando & Princes Town District.</i>				
Claxton's Bay—Forres Park estate ...	4.41	5.68	47.14	48.54
Pointe-à-Pierre—Bonne Aventure est. ...	8.35	4.82	52.22	55.70
" Concord estate ...	7.12	6.07	54.64	60.83
" Plein Palais estate ...	4.80	5.44	44.91	52.77
Naparima—Pieton estate ...	9.02	4.28	45.22	43.46
" Usine St. Madeleine estate ...	8.94	4.18	50.65	63.03
" La Fortunée estate ...	7.59	3.05	49.34	49.22
" Lewisville, San Fernando... ..	8.29	5.09	54.86	65.82
" Tarouba estate ...	4.24	2.43	35.58	45.29
" Union Hall " ...	7.36	3.55	46.62	51.29
" Palmiste " ...	8.41	3.55	50.52	56.02
" Hermitage " ...	8.12	3.75	48.27	51.81
Princes Town—Craigish " ...	11.30	4.59	58.80	59.03
" Cedar Hill estate ...	10.44	5.42	55.91	58.62
" Williamsville estate ...	9.09	5.42	58.73	58.62
" Esmeralda Estate ...	9.53	6.95	62.04	64.03
" New Grant estate ...	14.01	5.04	71.69	65.04
" Constabulary Station... ..	7.77	3.46	40.29	46.31
" Mindustan estate ...	12.12	5.55	59.77	61.97

RAINFALL RETURN FROM JAN., TO DEC., 1914.—CONTD.

Stations.	December, 1914.	December, 1913.	Jan. to Dec., 1914.	Jan. to Dec., 1913.
<i>San Fernando and Princes Town District.—(Cont'd.)</i>	Ins.	Ins.	Ins.	Ins.
Princes Town—La Retraite estate ...	15.32	8.34	90.01	86.76
" Malgretoute estate ...	10.44	4.13	55.45	55.62
Savana Grande—Friendship and Ben Lomond estates ...	9.60	5.21	56.32	56.32
Poole—El Rosario estate ...	15.39	5.94	76.89	81.33
<i>Montserrat District.</i>				
Montserrat Constabulary Station ...	7.22	6.28	53.78	63.46
Brasso—La Vega estate ...	11.59	7.52	67.89	75.65
<i>Arima District.</i>				
Arima—Warden's Office ...	7.56	1.00	48.94	55.91
" Torrecilla estate ...	15.11	5.26	84.23	81.87
" Verdant Vale estate ...	11.00	6.22	75.84	80.52
San Rafael—Constabulary Station ...	15.44	7.07	86.63	89.89
Guanapo—Talparo estate ...	11.52	5.20	69.73	83.88
" San José Estate ...	14.28	...	...	...
Tamana—Sta. Marta estate ...	16.02	6.71	90.07	95.35
<i>South-west District.</i>				
Oropuche—Constabulary Station ...	8.57	5.09	67.05	59.02
" Pluck estate ...	9.65	3.36	55.56	46.49
Siparia—Constabulary Station ...	14.74	7.25	84.20	84.01
" Alta Gracia ...	11.19	...	...	...
Guapo—Adventure estate ...	9.15	3.34	59.35	59.99
Cap-de-Ville—Constabulary Station ...	8.94	6.08	81.25	86.77
Erin—La Ressource estate ...	12.02	7.12	62.81	71.55
" Industry estate ...	10.65	6.53	64.16	...
Cedros—Constabulary Station ...	6.37	3.13	53.66	47.03
" Perseverance estate ...	6.67	3.44	52.03	...
Incocos—Constance estate ...	1.17	4.20	41.02	42.13
Irois—Irois estate ...	9.11	8.35	...	75.97
<i>South Coast.</i>				
Moruga—Constabulary Station ...	11.68	6.19	50.70	62.27
<i>North Coast.</i>				
Blanchisseuse—Constabulary Station ...	5.14	2.81	60.05	84.43
Grande Rivière—Mon Plaisir estate ...	11.70	7.20	89.65	121.74
Toco—Aragua House ...	7.62	3.50	63.42	83.05
" Constabulary Station ...	5.99	4.53	59.27	74.72
Point Galera—Light House ...	3.62	2.30	37.09	43.33
<i>East Coast.</i>				
Matura—La Juanita estate ...	11.80	6.97	78.87	103.27
Mauzanilla—Constabulary Station ...	17.25	5.99	83.44	87.06
Sangre Grande—Sta. Estella estate ...	15.31	5.72	89.63	102.10
" New Lands estate ...	15.87	8.31	88.50	93.94
" Evasdale estate ...	15.45	7.17	91.87	102.36
" Grosvenor estate ...	17.77	8.84	91.33	100.00
Mayaro—Constabulary Station ...	12.31	5.69	56.58	68.14
<i>Tobago.</i>				
Tobago—Hermitage estate ...	6.63	5.01	68.62	83.50
" Riversdale ...	6.06	2.24	41.99	56.05
" King's Bay ...	5.72	3.43	56.10	71.46
" Roxburgh ...	9.58	4.25	68.93	84.00
" Lure estate ...	8.77	3.21	70.28	81.27
" Botanic Station ...	7.71	1.58	51.74	54.95
" Government Farm ...	5.59	1.34	31.42	37.75
" Lowlands estate ...	5.33	1.72	39.66	45.92
" Friendship estate ...	4.71	1.95	41.87	47.06

NOTES ON THE RAINFALL OF 1914.

THE year 1914 has throughout the greater part of the Colony been drier than 1913, the only noteworthy exceptions being parts of the North-West and South-West districts.

At the Botanic Gardens, Port-of-Spain, the average rainfall for a period of over 50 years is about 65 inches. In 1912 it was 49·85, in 1913 only 39·58, the lowest on record. 1913 was however for most of the Colony a wetter year than 1912. In 1914 the conditions have been reversed, and the rainfall at the Gardens has increased to 54·12 inches whereas, as already stated, that of most other districts has decreased, even including the four stations at Diego Martin, only some 8 miles from Port-of-Spain. There are always local peculiarities in rainfall, but the following table will indicate that the decrease has been general, only 22 stations out of a total of 96 showing an increase of rain in 1914 as compared with 1913:—

District.	No. Station showing an increase.	No. Stations showing a decrease.
<i>North-West.</i>		
Port-of-Spain, St. Ann's, Diego Martin, the Islands	9	6
<i>Santa Cruz and Maracas</i>	8	4
<i>West Central.</i>		
Caroni to Couva	0	13
<i>San Fernando and Princes Town...</i>	5	18
<i>Montserrat</i>	0	2
<i>Arima</i>	1	5
<i>South-West.</i>		
Oropuche, Erin, Cedros, Icacos, &c.	4	4
<i>South Coast.</i>		
Moruga	0	1
<i>North Coast.</i>		
Blanchisseuse to Point Galera	0	5
<i>East Coast.</i>		
Matura, Sangre Grande and Mayaro	0	7
<i>Tobago</i>	0	9
Totals	22	74

The actual figures for 1913 and 1914 at all the stations are given on the two preceding pages.

BULLETIN

DEPARTMENT OF AGRICULTURE,
Trinidad and Tobago.

PART 2.]

1915.

[Vol. XIV.

CASSAVA.

RECENT DEVELOPMENTS IN TRINIDAD.

THE Cassava or Manioc plant, widely grown throughout the tropics, is an important source of food to the inhabitants, not only of tropical South America, the home of the plant, but also of tropical Africa and other countries to which it has been introduced. Cassava however, until comparatively recent years has mainly been used for local purposes and has played no great part amongst the commercial products of the world, the form in which it is best known being that of tapioca, which is made by separating the starch, heating it whilst slightly moist so that the grains swell, burst, and agglutinate into irregular masses. The main places of tapioca production are Brazil and Malaya. Recently as explained by Mr. Board (p. 29) greater calls have been made on the cassava plant to supply the ever increasing demand for starch and products which are derived from starch—glucose, alcohol, etc. These products are obtained on an enormous scale from maize or Indian corn, but maize has other very important uses and some other tropical crop is wanted to help supply the world's increasing requirements. This has caused attention to be directed to the possibilities of cassava cultivation on a commercial scale. Florida early took up the industry and has apparently made a success of cassava starch production, in spite of the handicap of a short growing season. Great as is the demand for cassava starch there is a greater market for cassava flour; and in the papers which follow, relative to the new factory at Palmiste, San Fernando, cassava flour is the product under consideration. There is also in Trinidad a new cassava starch factory described on pp. 40-42; and during the past few weeks a small starch factory has been erected at San Juan, near Port-of-Spain, and is now at work.

The Board of Agriculture held its regular January meeting at San Fernando, instead of in Port-of-Spain, subsequently breakfasted at Palmiste Estate, by the kind invitation of the Hon. Sir Norman Lamont, Bart., and then inspected the experimental factory. Here the whole process of the preparation of dried cassava and cassava flour was demonstrated by Mr. A. Vyvyan Board. The party returned to San Fernando where a public meeting was held in co-operation with the Naparima District Agricultural Society. The papers read at this meeting, and the discussion which ensued, are given below. These reports are based on the full accounts of the meeting which appeared in the *Port-of-Spain Gazette* and *The Mirror*, with additions by the respective authors. To these

reports have been added other articles on "Cassava as a catch crop," "Cassava in St. Vincent" "Alcohol from Cassava" and "Prussic Acid in Cassava" which will also be of interest at the present time.

The following references will be of service to those who wish to go more fully into cassava cultivation and manufacture :

Le Manioc.—By Paul Hubert and Emile Dupré.

H. Dunod and E. Pinat, Paris, 1910. Price 8s. 0d.

Cassava.—By S. M. Tracy.

"Farmer's Bulletin," No. 167. United States Department of Agriculture, 1903.

Agricultural Basis of the Cassava Industry.—By H. Cousins.

"Bulletin Department Agriculture, Jamaica," II. 1904 pp 193-5.

Industrial Prospects of Cassava Starch.—By H. Cousins.

"Bulletin Department Agriculture Jamaica," I. New Series 1909, pp. 53-7.

Cassava Starch and its Uses.—By E. Everington.

"West Indian Bulletin" XII. 1912. pp. 527-9.

Cost of Cultivation of Cassava in St. Vincent.—By W. N. Sands.

"Agricultural News" XIII. 1914. p. 86.

W. G. F.

THE COMMERCIAL POSSIBILITIES OF CASSAVA.

By A. VVYAN BOARD.

Mr. Board said that he was afraid that a great deal of what he had to say would be old to the members of the Board of Agriculture, because during the two or three hours that they had been together during the day they had nearly exhausted the subject, but he hoped that they would bear with him if he repeated what had been already said. He began by explaining the essential difference between the cassava proposition he was advocating and that with which they were more familiar. Hitherto, cassava for commercial purposes, as distinct from cassava grown for human food, had been worked up into a high-grade white starch. In the West Indies they were very accustomed to the process and familiar with the product. The process is carried on by the people on a small scale, but it could be carried on on a very elaborate scale. He then explained the process of making starch from cassava, and said that an excellent factory of this type existed at Carenage. The chief competitors of cassava starch were sago and potato starch.

The industry which he was trying to start in no way superseded cassava starch, but would open up an extensive field for cassava which could not be touched by the high grade starch owing to the high cost of manufacture. Cassava starch was a comparatively expensive product which must be sold in England at from £11 to £15 per ton to show a profit. Cassava flour such as they were making was sold at £7 per ton in the English market, and on account of its lower price could enter markets which were closed to the higher grade product.

COMPETITOR OF MAIZE.

There was a great future before the cassava industry as a competitor to maize (Indian corn) and maize products in the numerous industries which required some form of carbohydrates for their manufacture. When it was remembered that the world's maize crop was almost as large as its wheat crop, it would be readily seen that there must be a large field for a similar starch-producing material. The demand for maize in the last few years had been in excess of the supply with the natural result that there had been a considerable advance in prices, and manufacturers were ready and anxious to find a material which would even only partially relieve them of the necessity of relying entirely upon maize. In the fermentation industries such as brewing and distilling, cassava had a great natural advantage over maize, in that it was almost entirely free from oil and albuminoids. Oil was very deleterious to fermentation and so the oily part of the maize had to be removed before it could be efficaciously used, in brewing especially. He then explained in detail how the oil bearing part of the maize was extracted before the maize was used. The oil and albuminoids in the cassava flour which he produced amounted to about 2 per cent., which was too low to affect fermentation. The average percentage of carbo-hydrates in maize was 60 and in cassava flour 84. These were facts which spoke in favour of cassava flour.

PRODUCTION IN THE EAST INDIES.

When they were laying their plans some years ago for the developing of the new cassava industry it became abundantly clear that to be successful in competition with maize they had to produce a material that would be simple to manipulate, and which would offer few difficulties to the user. It was obviously then impossible to ship cassava, containing as it did between 60 to 70 per cent. of water, in its green condition to England and expect it to arrive fit for manufacturing purposes. And so the cassava had to be dried. He explained that in the East Indies, where the cassava, known as manioc, is planted by small proprietors there was a comparatively simple method to slice it and put it out in the sun to dry. He compared this method with the artificial drying method at the factory at Palmiste and showed the advantages gained by the latter system. Up to a few years ago all the cassava used in their factory in England, came from the Dutch East Indies and it had suggested itself that as there were British colonies with geographical positions and climates suited to the growing of cassava, the natural thing to do would be to see whether future supplies could not come from one of these possessions.

EXPERIMENTS IN TRINIDAD.

Of all the tropical colonies to choose from, Trinidad suggested itself as being the most favourably placed. (Loud applause). After some preliminary experiments, lasting over a couple of years, had been carried out arrangements were come to with Sir Norman Lamont and Tennants Estates, Ltd., that if they would grow an acreage sufficient to yield a working quantity of cassava his firm would erect a temporary plant to deal with their crop so that the industry in Trinidad might be given a trial both from a manufacturing and cultivating point of view. Members of the Board of Agriculture had that

ay seen the little factory. It was of a temporary nature erected more with an eye to economy as to capital cost than cheapness of manufacture.

e again referred to the sun drying methods of the growers of cassava in the East and explained minutely the mechanical drying process at his factory. He next explained the process of manufacturing the cassava flour. When the roots are brought to the factory they are put in a rotary cleaner where they are cleaned. The woody parts of the root are cut off and it is put in a disc cutter where it is cut to small pieces. These are then subjected to considerable pressure and about 15 per cent. of moisture is removed. This moisture has a considerable amount of starch in it which is recovered in the ordinary way. The cassava is then dried and ground into flour.

SUGGESTIONS FOR THE FUTURE.

With regard to the prospects of the future, the success of the industry naturally depended upon whether it would pay the planter to grow cassava or not. He would leave the question of cultivation to the expert hands of the officers of the Department of Agriculture. He was continually being asked what price he would pay for cassava; and he usually tried to avoid the question (*laughter*) as it was rather early to answer until he had had more experience of running the factory under Trinidad conditions. But he could safely say that in the neighbourhood of 20s. per ton, a very profitable business could be worked up. He could quite understand that planters might be chary of entering into a contract to supply a certain tonnage of a crop of which they had not had much experience as they might with a certain amount of truth say that they were taking all the risk of the crop while the manufacturer was more or less sure of his profit on what he produced. That difficulty might be overcome by means of a co-operative factory in which the growers might have a definite capital interest, or it could be arranged that the manufacturer pay a definite price for the roots he received, and in addition pay to the grower a definite portion of the profits made by the factory. (*Loud applause*). In that way the grower would feel that he was getting his fair portion of the profits and he would feel he was interested from the moment the cassava stick was planted until the finished product was used in some factory in England or America. He only put this forward as a suggestion that might be worth consideration in the future.

In the event of a factory being erected and a permanent industry established he believed that much could be done with cassava farmers on the same lines as cane farmers. (*Loud applause.*) There was a considerable quantity of cassava grown chiefly for shade purposes but it was impossible now to do anything in the way of making use of these supplies as the cost of cartage was high. He found that the cartage was one dollar per load from Siparia, or \$2 per ton, which would make a big hole in the amount paid per ton. He submitted that this should be met by the establishment of depôts where the factory could purchase the cassava from the farmers.

There were many problems yet to be solved with respect to the cassava industry but personally he felt that there was nothing insurmountable. So that in time the cassava industry in Trinidad might become as large and profitable here as it was in other parts of the tropical

world. The French were at present developing a cassava industry in Madagascar on a large scale chiefly to supply her alcohol and glucose markets. France was in a very fortunate position as it is a country in which there is protection and industries in her colonies were protected by tariff. It was impossible to say but some of them thought they saw the day not far distant when some form of Colonial preference might be agreed to and when that day came the demand upon these colonies which already had an established cassava industry would be a very large one indeed. (Loud applause.)

The following specimens were exhibited: Liquid glucose, solid glucose, alcohol, cassareep and syrup, all prepared from the cassava grown at Palmiste.

CAPACITY OF THE FACTORY.

In reply to a question by Professor Carmody as to the capabilities of the factory, etc., and the market in England, Mr. Board said that the factory would have no difficulty in placing 10,000 tons of the dried product which was equivalent to 30,000 tons of the green roots. He stated that he would not suggest the erection of a permanent factory if they could not get half that amount to deal with.

THE CULTIVATION OF CASSAVA.

BY W. G. FREEMAN,

Assistant Director of Agriculture.

Mr. W. G. Freeman said he thought that everybody's ideas on the possibilities of cassava had been considerably enlarged by Mr. Board's lecture, and by their visit to the cassava factory at Palmiste. In the course of his remarks Mr. Board had contrasted the demand made on cassava and maize plants to meet the requirements of the industrial world. This was a competition amongst plants both entirely unknown to Europe until Columbus came and discovered the New World, when tobacco and potatoes were also brought into notice. All these valuable plants had since been widely spread all over the world, and cassava was a staple of food of many races of mankind in different countries. They were now about to deal with cassava in Trinidad as an industrial proposition and this was owing to Mr. Board's visit to our island. He might mention as an instance of the advantage of sending representatives to exhibitions, etc., that it was at the Rubber Exhibition, held in London in 1911, that Professor Carmody our delegate met Mr. Board and discussed cassava possibilities with him; the outcome of this might be a new and flourishing industry. He (the speaker) also took the opportunity in 1913, when he was in England, of paying a visit to Liverpool, where he saw the factory and mills where they were dealing with large quantities of cassava imported from Java and Madagascar.

There was already a factory in the north-west of Trinidad (at Carenage), for the manufacture of cassava starch which was visited by His Excellency the Governor on the occasion of Princess Marie Louise's stay here. There was also a small one at San Juan founded by the enterprise of a man from St. Vincent, which island had been exporting one to two thousand pounds worth of cassava starch annually.

To-day he desired to discuss the desirability of asking cultivators in the colony to turn their attention to cassava. The cultivators had the advantage that there was at either end of the island a factory which would afford them a ready market for their produce, and if Mr. Board's venture was a success he would be able to erect a big factory, capable of dealing with immense quantities of cassava. They were thus asked to give their attention to a crop for which a ready market was to hand. It was not a question of growing a crop for export with the consequent uncertainty and delay. Mr. Board hoped very soon to have a definite organization for the purchase of cassava. Cassava would thus be saleable in both large and small quantities and consequently would rise to the position of an industry which could be taken up by the estate owner and the small cultivator.

Cassava had to be considered from two points of view (*a.*) as a subsidiary crop, grown as temporary shade for cacao, etc., and (*b.*) as a definite crop.

CASSAVA AS A CATCH CROP.

They all knew the value of cassava more or less. No one, he was sure, was against planting cassava, because it was already grown; but what is wanted is that it should be grown to a greater extent. In the Malay Peninsula cassava had been strongly recommended as a catch crop on rubber estates because the getting out of the roots was an advantage to the cultivation as it broke up the sub-soil. Some figures relating to the cultivation of cassava as a catch crop had been kindly supplied by Mr. W. Greig, who reaped a total of 58 tons in May and June last year. The cassava was planted 4ft. x 4ft. in a field with limes; the cost of cleaning, draining and round ridging had been charged against the limes; that of holing, planting and weeding worked out at \$2.40 per ton; digging and heading, \$1.21 per ton; carriage and delivery 1 mile distant, 50 cents; making the total cost of the cassava delivered at the boat \$4.11 per ton. From the fields reaped at 10-11 months from date of planting there was a yield of 5.63 tons per acre. Mr. Greig was planting another crop and these results were very useful, as in Trinidad actual figures on cassava cultivation were very scarce.

CASSAVA AS A MAIN CROP.

There was very little cultivation of cassava in Trinidad by the acre and hence the absence of figures as to cost, yield, etc. There was however a general agreement that the conditions in Trinidad were not very dissimilar to those of the neighbouring islands and he would quote a few results to show the produce of the crop per acre. In Dominica, Mr. Everington, a planter who made cassava starch, got an average yield of 8 tons per acre and he sometimes got as much as 12 tons over a number of acres. In Jamaica where the crop had received considerable attention the yield ranged from 4-15 tons per acre; Surinam 8-15 tons; Madagascar 9-12 tons; Brazil 15 tons; Paraguay 7 tons; Cochin China 6 to 9 tons; Malacca 10 tons; British Guiana, about 12 tons, New Caledonia 15 tons and Guadeloupe 20 tons per acre. From the above it could be seen that the yield in various parts of the tropics was about 8 tons per acre and that was a fairly safe estimate which they ought to attain.

EXPERIMENTAL WORK.

Information was also necessary as to the yield of the different local varieties. The Department had a collection of imported varieties under trial, but cassavas of high value in one country did not always maintain their heavy yields when grown under other conditions and good results would be obtained by selecting heavy yielding local varieties. As had been suggested in another West Indian colony; if they could resurrect one of the old Caribs who was dependent solely upon cassava they would probably get much useful information. Small cultivators did know a great deal about cassava, but it had not yet attracted serious attention on most estates. In order to obtain information on the yield of four local varieties and the best planting distance the Department of Agriculture had laid down in May and June 1914 at St. Augustine a set of experiments according to a plan which had been submitted to and approved by the Experiment Committee of the Board of Agriculture. The planting distances which were being tried were $2\frac{1}{2} \times 2\frac{1}{2}$; 3×3 ; 4×4 ; 5×5 ; 4×6 , and 6×6 , with pigeon peas. Comparative trials were also being made with top, bottom and middle plants (cuttings), with holes 2 feet square forked previous to planting and with ploughed land. The full scheme of these experiments was to be found in the *Bulletin* xiii. 1914, p. 212. With respect to the cultivation proper cassava should apparently be planted in May or June. It required at least two weedings as it was a plant which did not cover the ground effectively and it was quite possible that pigeon peas or other useful crop could be planted between so as to reduce the cost of weeding.

COST OF CULTIVATION.

As to the cost of cultivation as a field crop there was but little local information as yet. In Jamaica it ranged between £3 10 and £5 per acre and a well managed estate could be run at £4. In St. Vincent it cost about £4 an acre and in Trinidad it appeared reasonable to estimate that the cost should not exceed £5 to £6. Then with a return of 8 tons per acre there was a hope of a fair profit.

With reference to the question of the period of growth before digging he said that there was much to be learnt. Some were of opinion that the plant was full grown in ten or twelve months and it was also stated that if one dug the roots at that time one would only get two-thirds the crop obtainable in fifteen months. There was much room for experiment as to whether it would be advantageous to let the roots remain for more than a year and whether although the longer period crops might be heavier, the increase in value would more than counter-balance the increased cost of cultivation and the reduction in the number of crops over a term of years.

CASSAVA AS A ROTATION CROP.

MM. Hubert and Dupré in their useful book *Le Manioc* advocated cassava as a rotation crop on sugar estates, and detailed a system practised in some colonies. Canes are grown for six years, then cassava and corn until the beginning of the eighth year, then a leguminous crop and the ninth year a return to canes again. He thought it quite feasible that cassava might take a place as a rotation crop on sugar estates here and hoped that the sugar planters would consider the matter and see what was possible under local conditions of labour, etc. On general grounds a change of crop was

of direct value in keeping down pests addicted to the sugar cane as if they did not find a congenial home on the cassava it assisted in their extermination.

Cane farming was well established in the colony and now that there would be a ready market for cassava, that line could be followed, as the factories would undertake to take all the cassava grown at a fixed price.

In conclusion he hoped that all cultivators, both large and small, would give their consideration to the possibilities of cassava which appeared destined to occupy a much more important place in the world than it did at present.

DISCUSSION.

SIR NORMAN LAMONT said he was afraid he could add very little to what was said in the excellent speeches to which they had listened but as he had been in the new industry for a couple of years, he might refer to one or two small points. First of all he wanted to emphasise the fact that in all he had done, he was merely feeling his way as it were, and trying to gather knowledge as he went along. When Mr. Board approached him three years ago as to his putting in 50 acres of cassava, a crop which he had never grown before, he quite realized there was small probability of profit; but he realized also if there was not much probability of profit, there was not much of loss, and ultimately there might be a possibility of profit for himself and the Colony in general if they succeeded in getting a new industry established. (Hear, hear).

His first difficulty was that in putting in 50 acres of a new crop, it was almost impossible to get plants. As a result he had to scour the country from Siparia and La Brea to Williamsville and in doing so, he could make no attempt at selection, with the consequence that his cassava fields presented a somewhat mottled and variegated appearance. (Laughter).

On the question of yield he would quote from a letter received from a member of the Board of Agriculture, Sir Townsend Fenwick—who in regretting his inability to attend the meeting, said “the cassava cultivation would have interested him because it was so generally used in Mauritius where he had had 28 estates under his supervision and where in good lands the yield was 20 tons per acre.” His own results up to the present were nothing near that; in fact, he had not even yet succeeded in getting 8 tons per acre, but he hoped with further experience to do so, for it was by no means out of the question to do in Trinidad what Mr. Everington had done in Dominica.

One question was whether they should plant flat on the beds or on banks as in the case of sweet potatoes; another what was the best distance apart? Another problem arose in connection with the number of weedings. When he originally drew up an estimate he only reckoned on two weedings which was found in practice to be far too few and in one field, he had had to give five. Cassava grown as a pure crop gave very little shade and it was hard therefore to keep down the grass, and other weeds. In

* See article on “Cassava in St. Vincent” p. 45, which has been received whilst this *Bulletin* was in the press.—[Ed.]

a field which the Board had seen to-day a dressing of 2 cwt. per acre of muriate of potash had been given, but the weeds seemed to have got most of the benefit. But it was possible for that difficulty to be got over, by planting more closely or putting some cover crop in between.

Another important point was the period at which it was best to reap and what time should elapse between planting and reaping. Additional growing time might mean additional weight per acre, but on the other hand it would certainly mean additional weeding. And they did not yet know at what period the roots began to go back. He knew that in one field of twenty months at La Resource, the cassava certainly went back after the eighteenth month. The best time for planting was early in the wet season which would allow the crop of cassava to be reaped at fifteen months old, without losing the following wet season for planting purposes.

He thought cassava would also prove itself to be quite a useful rotation crop. He had planted one field at Cedar Grove in 1912 and in the autumn of 1913 it was planted in cane and, so far as he could judge by the appearance, that field now looked as good a field of plant canes as any on the estate. So that he thought that disposed of the universal idea that cassava was such an exhausting crop that nothing else would grow after it. He thanked the members of the Board for their visit to Palmiste and the interest they had taken in the new industry which he hoped would be to the benefit of the planting fraternity of Trinidad. (Applause)

PROFESSOR CARMODY said that he would just add a few words to the instructive addresses of the former speakers on the subject. He wanted the public first to understand that the proposition they were asked to consider was an entirely different one from any ever put before them. At present there were three factories in the island, two for the manufacture of cassava starch, and the third at Palmiste on Sir Norman Lamont's land for the manufacture of a special product—cassava flour, as well as for making starch. Cassava was coming to the front as an industrial product and even in Trinidad it was being forced to the front by the turn of events. There must have been some special demand for cassava in the markets of the world to have caused Mr. Board to come here to obtain a supply. What they wanted to-day in Trinidad was to make the manufacturer pay as high a price as possible per ton and for the cultivator to produce as many tons as possible per acre. (Laughter and cheers). But they must remember the price per ton was governed by the markets abroad and Mr. Board must satisfy himself that he could buy at a price which, with the cost of manufacture added, would enable him to sell to manufacturers in England at the price they could buy at, and they (the land owners) must discover the lowest amount they could sell at to cultivate the cassava successfully. Mr. Board, like some other pioneers he knew, was willing to give a fair price and he had not yet any fixed price. As Mr. Board had told them he had co-operation in his mind as the cultivator under that system would be given a fair share of the profits. Cassava had been grown in this Colony for hundreds of years, and used as a food by the grower. The cost of production did not matter when grown for this purpose on a small scale, but on a large scale it must be considered for the reason given above. Mr. Freeman had suggested many points regarding its cultivation and he hoped they would think over them. Unfortunately they had no official figures in Trinidad of what the yield

per acre was, and the first thing they had to do was to select a variety which was more productive or more prolific. If they could produce 8 tons per acre there would be very good prospects to the cultivator. He mentioned the experiments that were being made by the Department of Agriculture and stated that the results would be published in the *Bulletin* and hoped that every planter would get one supplied as they were entitled to that. He referred to the question of the rotation of crops and hoped that cassava would be considered from this point of view by the sugar planters. Continuing the speaker pointed out the exhaustion to the soil caused by the continual planting of one crop and brought in the value of cassava as a rotation crop especially when there would be a local market for it. He concluded by pointing out the great possibilities of the industry here if Mr. Board's efforts succeeded, and the benefit it would be, not only to the planters but the Colony generally. It would be deeply regretted if this opportunity were lost, and Mr. Board's factory, or the Carenage factory, closed down through insufficiency of the supply of the raw material.

FUNGOUS DISEASES OF CASSAVA.

By JAMES ARCHER RORER,

Mycologist, Board of Agriculture, Trinidad and Tobago.

Although cassava in many parts of the tropics is subject to several different fungous diseases which may become quite serious at times, in Trinidad, up to the present, the plant has been remarkably free from troubles of this kind. This freedom from disease is undoubtedly due to the fact that cassava is, or rather has been, grown here primarily as a catch crop, planted at wide distances and interspersed with other crops. Under such conditions fungous diseases cannot spread rapidly or do much damage,—individual plants here or there may be affected, but there can be no epidemic. Now, however, things are beginning to change, and with three factories using cassava, at work in different parts of the island, the demand for cassava roots has already become, or soon will become, so great, that it cannot be met only by the catch crop planting. If the factories are to be kept supplied, which every one hopes will be the case, regular planting of this crop will have to be made. Naturally when this is done, when large areas are planted in this one crop, diseases will begin to creep in and unless checked, they will have every opportunity of spreading rapidly from plant to plant and may cause failure where success was anticipated.

The fungous diseases of cassava may be divided into three classes; those which attack the leaves, those which attack the stem, and those which attack the root.

Two leaf diseases of cassava are quite common in Trinidad but it is difficult to say exactly how much damage they do. Perhaps you do not all know that the leaves are the food manufacturing centres of plants. All the food substances which the roots take up from the ground are merely raw materials and must be carried up to the leaves where they are worked up and combined with other substances absorbed from the air, and then these elaborated products are sent to all the growing parts of the plants. Of course all plants make much more food than is actually

needed for their growth, and this excess of material, generally in the form of starch or sugar, is stored in the stems, seeds or roots. This stored food is the provision which the plant makes for its maintenance of life from generation to generation. In cassava the storage of food takes place in certain roots.

LEAF DISEASES.

Now to return to leaf diseases.—bearing in mind what has been said in regard to the function of leaves—naturally a plant which has numerous and healthy leaves can make more food than one which has lost its leaves as a result of diseases or pests. One often sees cassava plants with only a small tuft of leaves at the top of a long naked stem. At times this may be the result of natural causes but fungi also assist in the defoliation.

Leaf diseases attributed to different species of *Cercospora*,—*C. manihotis*, *C. cassava*, *C. henningii* and to *Gleospodium manihoti* have been reported from Brazil and adjacent parts of South America, Cuba, Florida and Tropical Africa, in fact from practically all countries where cassava is grown. The species of *Cercospora* cause leaf-spots while *Gleospodium manihoti* attacks chiefly the leaf stalk and causes the whole leaf to wilt.

In Trinidad two types of leaf spots are commonly found. One, which may be called the "white" leaf-spot does but little damage. The spots are quite small, $\frac{1}{8}$ to $\frac{1}{2}$ in. in diameter, the diseased area being white, surrounded by a narrow brown or purple border. The other, the "brown" leaf-spot causes many leaves to fall prematurely. The spots are larger, $\frac{1}{4}$ to $\frac{1}{2}$ in. in diameter, and so numerous that they often coalesce, thus destroying a considerable area of the leaf blade. The diseased tissues are brown surrounded by a distinctly darker margin.

A spraying experiment has been started this year for the purpose of determining exactly the amount of damage done by these fungi which attack the leaves. A plot of cassava has been divided into four equal parts, two of which have been sprayed at regular intervals and the other two left unsprayed. When the plants are dug, whatever benefit has been gained from the spraying will be shown by the weight of roots from the sprayed plots as compared with that from the control plots. So far the plants do not show a very marked difference, but on the whole the sprayed ones seem to be in a little better foliage.

STEM DISEASES.

From Brazil, the home of cassava, two diseases of the stem have been reported. The more destructive is due to a bacterium, *Bacillus manihotis*. The first sign of the disease is the appearance of small water-soaked areas along the stem. These spots soon increase in size, and finally girdle the stem; then the leaves wilt and finally the plants bend over and finally break. In the publication describing the disease, issued from the Agricultural Institute of São Paulo, a plate is published showing a whole field of cassava destroyed by this disease.

Gleospodium manihoti is also reported from São Paulo as the cause of a stem disease.

ROOT DISEASES.

Cassava in Jamaica suffers from a root rot supposed to be caused by a fungus. The disease is most common in newly cleared land and it is possible that the fungus spreads from decaying tree roots to the roots of the cassava. Very little is known about this trouble. A bacterial root rot of cassava has been reported from the East.

As we said at the outset, so it may be said in conclusion, cassava is wonderfully free from fungous diseases in Trinidad, and every effort should be made to keep it so. Watch your plants carefully, and if at any time you see anything which is not exactly as it should be, send specimens to us and we will gladly do all we can to help you in combatting the trouble.

CASSAVA INSECTS.

By F. W. URICH, F.E.S.,

Entomologist, Board of Agriculture, Trinidad and Tobago.

CASSAVA is not extensively grown in Trinidad and Tobago. It is generally planted on cacao estates as a catch crop or as shade for the young trees. The result is that there are not enough plants to facilitate the increase of insect pests, and partly for this reason, and also on account of the natural control existing, none of the insects found on cassava have become numerous enough to be classed as pests. It is however as well to call attention to some of the insects found on cassava which may become pests as soon as the balance of nature is upset. It is well to bear in mind that prevention is better than cure, and any tendency to increase of any of the insects on cassava should be checked at once.

THE BUD MAGGOT (*LONCHÆA* Sp.)

In order of importance, the bud maggot takes first place, and is the worst pest that has been observed here up to now. The parent fly lays its egg on the tip of developing leaves of the bud, and the maggot works into the soft tissues of the growing point of the plant and destroys it completely. When the young shoot is destroyed, the plants naturally send out others at the sides with the result that instead of a long straight shoot, there are numerous small ones all branching from the main stem. In a severe infestation, nearly all the young shoots will be attacked as fast as they appear, and the proper growth of the plant will be considerably hampered, and in some cases checked. After attaining its full size, the maggot drops to the ground and then transforms into a pupa, from which the mature fly emerges in due course. From the fact of the fly always choosing the youngest shoots to deposit its eggs, control by spraying is hardly likely to be effective, and the best control measure would be to cut off and burn all the affected shoots every ten days. I have not yet made a special study of this fly, but as far as I have observed, it appears to be more numerous at the opening of the rainy season, on small plants, although at other times it is entirely absent from cassava plants. So far no natural enemies have been found. According to Cardin the larval period in Cuba occupies a period of twenty-three days,

and the pupal stage lasts twenty-six days. According to this author, the bud maggot is distinctly injurious in Cuba; at the Experiment Station at Santiago, 86 per cent. of the plants were attacked.

THE LEAF MITE.

A small mite attacks young leaves and causes them to become dwarfed and spotted. It is not numerous as a rule but if plentiful is capable of doing damage. If it becomes numerous, the affected leaves should be dusted with flowers of sulphur, or sprayed with a weak solution of lime sulphur; care being taken to apply the spray to the underside of the leaves.

THE CASSAVA HAWK MOTH (*ERINNYIS ELLO*, L.)

The caterpillar of this moth is not very numerous, thanks no doubt to natural enemies of which two very effective ones are commonly found all over the island. One is a minute hymenopteron which lives in the egg and completely destroys it and the other is a parasite of the caterpillar. Affected caterpillars are enveloped in a cottony mass, made up of the numerous small cocoons of the parasite all massed together. These parasites have not yet been determined, but the egg parasite is probably a *Telenomus* and the other a *Microgaster*. The caterpillars are capable of doing injury if unchecked. The moths are on the wing all the year round, and appear to oviposit during every month. They feed on Hevea, Papaw and Poinsettia.

THE GALL MIDGE (*LASIOPTERYX* Sp.)

The red growths or galls often seen on the leaves of cassava are caused by a small yellowish midge, which deposits its eggs in the tissues of the leaves. As the young larvæ develop the gall increases in size. As far as I have observed these galls are never numerous enough to do any harm. The midge is kept in check by one or two hymenopterous parasites.

THRIPS (*CORYNOTHRIPS* Sp.)

A comparatively large Thrips, about 1.5 m.m. long, of a yellow colour with brown and red markings, is found on the underside of young leaves. It is not numerous enough to do any damage, but in any case it appears to be kept in check by a parasitic fungus possibly an *Entomophthora*.

CASSAVA LACE-WING BUG (*FAM. TINGITIDÆ*).

These delicate bugs are found in several districts of the island, and live on the underside of the leaves, from which they abstract the sap. They do not occur in sufficient numbers to cause any damage.

PARASOL ANTS (*ATTA CEPHALOTES*, L.)

In the neighbouring colony of Cayenne, parasol ants are called "Fourmi Manioc" possibly on account of their liking for cassava. In Trinidad a cassava plant is occasionally defoliated by these ants, but as a rule only when there is not much young cacao leaf to be had. These ants could however be troublesome in fields where only cassava is grown.

RECORDS OF CASSAVA INSECTS IN OTHER COUNTRIES.

In Cuba where cassava is cultivated on a fairly large scale, according to Cardin (1), the following insects are pests of some importance :—*Lagochirus obsoletus* a longicorn beetle which burrows in the stems of the growing plants somewhat after the manner of the cacao beetle. The larva of the fly *Lonchaea chalybea*, an allied species of which we have here ; and the caterpillar of the moth *Erinnys ello*, L.

Ballou (2) reports that at the Agricultural School, St. Vincent, cassava was attacked by a species of thrips which caused a considerable defoliation of the leaves, but he did not believe that it caused very much injury to the crop. The same author also mentions a lace bug *Corythuca* sp.

Birkinshaw (3), writing from St. Vincent, says that on one estate a field of cassava was so badly infested with mealy bug, that the crop was entirely spoiled. Referring to some thrips forwarded by Birkinshaw from St. Vincent Williams (4) states that two species from cassava were in the collection, one belonging to the genus *Frankliniella* and the other to a new genus which he named *Corynothrips*.

Lamborn (5) mentions that in the Southern provinces of Nigeria cassava was attacked and defoliated by locusts (*Zonocerus variegatus*, L.)

TRINIDAD PRODUCE COMPANY'S FACTORY AT CARENAGE.

By H. A. NEAL, Attorney and Manager.

THIS factory combines the manufacture of citrate of lime and cassava starch in two separate departments. The capacity of the citrate of lime plant is equal to 500 barrels of limes per twelve hours day. By working continuously night and day, the capacity is over 100,000 barrels of limes per season. Limes are purchased either at the flat rate or on a sliding scale according to the fluctuations of the London market. The latter arrangement has all the advantages of a co-operative system and enables the grower to share in the profits of the factory.

WORKING CAPACITY.

The cassava plant has a continuous working capacity of 40 tons of roots per day and works on what may be described as the "wet system" that is to say that the starch is not dried until it is finished. This process has the advantage of reducing the labour cost to a minimum, and at the same time ensuring the utmost purity of the finished product.

PROCESS OF MANUFACTURE.

The roots immediately on receipt at the factory are placed in the washing machine which operates by means of numerous sprays of high pressure water. They are ejected from this machine into the hopper of the first grinder which reduces the roots to a fluid pulp. This pulp is pumped into the separating machine which removes the bulk of the fibrous matter.

(1.) *Insectes y enfermedades de la yuca en Cuba* Bol. No. 20, Julio de 1911. Estacion experimental Agronomica.

(2.) *Report on Agricultural Department, St. Vincent* 1912-13.

(3.) *Report on the Agricultural Department, St. Vincent*, 1913-14.

(4.) C. B. Williams "on two new species of Thysanoptera from the West Indies" *Journal of Economic Biology*. Vol. 8, pp. 209-215.

(5.) *Bulletin of Entomological Research*. Vol. V. page 198.

The remaining pulp is now ground again in a finer grinder and after passing through a second fibre-separating machine is pumped on to the final sieves which consist of fine silk cloth stretched on frames which have a rapid oscillating motion imparted to them; high pressure water is sprayed on the sieve tables. The starch and water from the sieves run into large settling tanks. In a few hours the starch has settled down in a firm mass and the water is run off. The starch is now taken by means of a conveyor to the washing tanks in which it is mechanically mixed with fresh water and the settling and draining process is repeated a sufficient number of times to eliminate all foreign matter. It is now ready for drying and the first process is performed in a special type of centrifugal.

The starch comes from the centrifugals in the shape of a hollow cylinder. These are passed through a grinder to break them up into small lumps and the starch is then taken in an elevator to the vacuum drier.

This consists of a large steam jacketed cylinder in which an elongated paddle wheel revolves. As soon as a charge is put in the drier it is hermetically sealed and a large vacuum pump is set in motion which exhausts the vapour from the drier. A charge, which is 1,200 lb., requires about one hour to dry. From the drier the starch is discharged into a closed conveyor which carries it to the pulverising machine from which it falls into the bagging machine.

In order to obtain the best financial results it is necessary, just as with a cane plant, that it should be run at as nearly full capacity as possible and this condition has not been satisfied so far owing to the comparatively small quantity of raw material offering.

PRICE OF ROOTS.

During the past season 25s. per ton has been paid for roots and there is no reason to suppose that this price cannot be maintained. The market for the finished product at a satisfactory price is large especially in the United States. Only recently a contract to supply a large weekly tonnage had to be declined owing to the supply of cassava being insufficient at the present time. It is interesting to note, in reference to the question as to whether cassava growing pays, that 25s. (\$6.00) per ton is the price ruling in Florida where the industry is well established. Labour costs are naturally higher in the United States and the climatic conditions are less favourable than here. It is reasonable to suppose therefore that it should pay the grower here well as soon as the best methods of cultivation to suit local conditions have been found.

CULTIVATION.

The best soil is a light rich sandy loam and it does not matter if it is underlaid by hardpan. It would be dry rather than wet. It is naturally impossible to lay down rules in regard to fertilizers, but a mixture of 2 parts of kainit to 3 of acid phosphate, applied at the rate of 200 lb. per acre, is found to give good results in the States where cow peas are usually grown in rotation with the cassava.

VISIT TO THE CARENAGE FACTORY.

The Carenage Factory which Mr. Neal has described above was opened early in 1914, and on May 11 of that year a visit was paid to it by H. E. the Governor, accompanied by H. H. Princess Marie Louise, Lady Le Hunte, and a large party of other guests. The whole process of the manufacture of cassava starch, from the cleaning of the roots to the bagging of the finished product was demonstrated, and at the conclusion of the inspection of the factory, Mr. Edgar Agostini, K.C., welcomed Her Highness on behalf of the Trinidad Produce Company; and in the course of his remarks said:—

“The establishment of the extensive factory was so to speak the beginning of a new and important industry for the colony. He congratulated Mr. André on the great work which he had started, and in no less measure did he congratulate Mr. Alfredo Siegert for coming forward and helping the movement, with the result that the factory was as he saw it, manufacturing cassava starch of a most excellent grade. The new industry was of the greatest importance not only for the Diego Martin Ward, but for the whole of Trinidad; and it would also help especially those who were far away from the sugar factories and could not therefore think of growing canes. These farmers he hoped would turn their attention to cassava, for which there would always be a big demand. He thanked the Princess for coming there that afternoon and asked her kindly to accept as a souvenir, from the Chief Director, Mr. Siegert, a sample of the starch manufactured. He wished her *bon voyage* and on behalf of all Trinidad and Tobago he hoped it would not be long before Her Highness would again honour them with a visit.” [Ed.]

MEETING AT ARIMA.

The monthly meeting of the Arima District Agricultural Society on February 8, was mainly devoted to cassava. Mr. W. G. Freeman, Assistant Director of Agriculture, gave a general account of the possibilities of the industry recapitulating the chief points of his paper at San Fernando. Mr. A. V. Board gave a description of the manufacturing process at the Palmiste Factory, and exhibited samples of the dried cassava chips and cassava flour. A good discussion followed on such points as the prices offered for fresh roots, sun dried cassava, yield, cost of transport, etc. Cassava is cultivated on a moderate scale in the Arima district, partly for the manufacture of starch, and previous to the meeting Mr. Board and Mr. Freeman visited some of the local cultivators and others likely to be interested in the extension of the cassava industry.

FURTHER DISCUSSION BY THE BOARD OF AGRICULTURE.

CASSAVA cultivation was shortly discussed again at the meeting of the Board of Agriculture on February 17.*

Professor Carmody at the conclusion of the general business said he desired with the Board's permission to introduce something that was not on the agenda, and that was to express their sincere thanks to Sir Norman Lamont for the very kind reception of the Board at Palmiste on January 20, and also for the very instructive day that they had spent in inspecting his cultivation and in seeing the process of manufacture of cassava adopted by Mr. Board. As Sir Norman had reminded him the Board's visit to San Fernando happened to coincide with his (the speaker's) birthday, and if it should also coincide with the birth of a new industry for the colony, they all would be very grateful indeed.

He believed that there was a great future for cassava, and that it would be possible to provide sufficient material to keep Mr. Board's mill fully occupied, and he hoped that in the near future, Mr. Board would get sufficient encouragement to enable him to extend the factory to a larger capacity. Everybody in the colony understood the cultivation of cassava; the only difficulty was to get it cultivated over a limited area and not scattered about as at present, so that the collection would not be so expensive. He thought the initial difficulties would be overcome and that the time would come when the cassava industry would be one of the most important in the colony.

In company with Sir Norman he inspected last week the other factory at Carenage which was equipped for the manufacture of a very large quantity of cassava starch. The two mills that were erected at present in the colony had a capacity far larger than the immediately available supply of raw material for their requirements, and it would be a very great pity indeed if either of them should be obliged to close down owing to the want of cassava. But his object that afternoon was not to discuss cassava, but to ask the Board to join with him in expressing their sincere thanks to Sir Norman Lamont for the very kind reception on the day of their visit. He also asked to be allowed to include Lady Lamont as their visit to San Fernando coincided with her latest visit to the colony; he hoped it would not be her last visit, and that they would have the pleasure of seeing her again if ever they went to San Fernando as a Board (*hear, hear*).

Sir Norman Lamont said he rose merely to address a few words of thanks for the way in which the Board had endorsed what the chairman had said and further to add, that he did not deserve thanks for what he had done on the occasion of the Board's visit to San Fernando. It was a very great pleasure to him, and he felt that any vote of thanks was due from himself to the Board for having given him the pleasure of their visit and the opportunity of spending such a delightful day. He had gained very many useful hints in the course of conversation in the field and factory as well as at the meeting in San Fernando.

* The summary here given is based on the report of the *Port-of-Spain Gazette* for February 18, 1915.

As Professor Carmody had alluded to the difficulty of obtaining sufficient cassava to keep the two factories going he might mention that by the last mail he received a letter from a friend, occupying a very important position in St. Vincent, who told him that planters there had taken up the subject exceedingly keenly on reading the report of the proceedings of the Board at San Fernando last month; and that it was quite possible that arrangements might be made to bring cassava from St. Vincent by sloop direct to Palmiste. If that were so, it might partially solve the difficulty of keeping the local factories going in the early years of the experiment.

He might also mention that the same mail brought him a letter from Tobago saying that the planters there had also read with keen interest the report of the Board's proceedings and the writer had suggested that he, the speaker, might use his special influence in order to get the Board to leave the Red House in Port-of-Spain and hold a conference in Tobago. But he assured that gentleman that he had used no special influence, and was only a passive agent in the matter, for the suggestion had come from the Director of Agriculture himself (laughter and applause).

Mr. Carr said it appeared to him there were two main factors in cassava growing, viz.: soil, and the cost of transportation. It was possible to grow cassava, and to obtain high returns on new Crown lands when they were again opened to the public; they might dry it in some central dépôt before sending it to the factory, which might partially solve the question of transportation.

Mr. Freeman said since the meeting at San Fernando, Mr. Board and himself had had another cassava meeting at Arima, on February 8. On that occasion they interviewed some large and small cultivators in the neighbourhood, and addressed a meeting of the District Agricultural Society. One of the immediate objects of Mr. Board's visit was to see whether he could make arrangements for cassava which could be sun dried locally, and he was prepared to offer £4 per ton for the same at the Arima Railway Station. It was not out of the question that cacao or other produce dealers in country districts might also deal in dried cassava, buying large or small quantities at a definite price so that the man with only a few barrels to sell could dispose of his produce locally for cash. Such a system was in operation in Java from which country Mr. Board's company in England obtained most of its supplies. The larger proprietor could easily dry cassava on an ordinary cacao house.

Mr. Board had recently visited Tobago and been impressed by the cassava cultivation he had seen and he proposed to establish a subsidiary purchasing and drying dépôt there.

He also desired to associate himself with the Chairman in his expression of thanks to Sir Norman Lamont for his public spiritedness in encouraging a new cultivation in the hope that it would prove to be of substantial benefit to the colony. (Applause).

Mr. Carr added that everything should be done by the Government to foster the new industry, and if new lands were thrown open to the public nothing would do more to help the cassava industry to success. He knew personally that lots of contractors and others had put money in the bank for the purpose of buying Crown lands when available.

CASSAVA IN ST. VINCENT.

By F. BIRKINSHAW, Acting Agricultural Superintendent.

WHILST this *Bulletin* was in the press the *Annual Report* for 1913-14 on the Agricultural Department, St. Vincent was received. The following interesting account of a trial made to determine the relative advantage of planting on banks (the usual practice in St. Vincent) and on the flat (the usual practice in Trinidad) is given as well as the results of a trial shipment of dried cassava to Montreal. It will be noticed that the value of dried cassava in Kingstown is put at \$21.72 which approximates closely to that offered by Mr. Board, namely, £4 (\$19.20) at railway stations such as Arima whence he would have to defray cost of carriage by rail to the factory:—

Field Experiments.

PLANTING EXPERIMENT.—FLAT v. BANKS.

“Two plots of cassava were grown with the object of ascertaining, with some degree of accuracy, the weight of green roots produced per acre. Like the arrowroot cultivation, in one section the cassava was grown on banks (which is the usual estate practice), whilst the other section was “flat.” In both cases the cuttings were planted at 5 ft. x 2 ft. The results this season showed an increase of yield of 3,525 lb. per acre in favour of the “flat” cultivation, the yields being at the rate of 17,570 lb. green roots per acre on the “flat” cultivation, and 14,054 lb. on the banked land. The soil in the two plots was, so far as appearances go, of similar fertility, and the plants themselves were ordinary estate cuttings, so that there is every indication that the increased yield may be attributed to the method of cultivation. As, however, one season's results cannot be definitely relied upon, the same point will be tested in next year's experiments.

“No selection work has been done with this crop, but it is proposed to make selections from amongst next season's plants.

EXPERIMENTAL SHIPMENTS OF DRIED ROOTS.

“In order to test the market in Canada for dried cassava roots, a trial shipment of the article was made to the West India Company, Montreal.

“The roots were sun-dried on galvanised wire mesh trays, such as are used in drying arrowroot starch. The average percentage of thoroughly dried roots was 88, although in some cases 40 per cent. was obtained. The product was shipped in ordinary cacao bags.

“The calculations given are based upon the results of the trial shipment, together with the trial at the Experiment Station. As will be seen, the dried cassava roots realised \$35 per Canadian ton of 2,000 lb. in Montreal. The average estate yield of 10,000 lb. per acre was calculated from information given by a local planter, who cultivates a considerable area of cassava each season.

SUMMARY OF DATA CONCERNING DRIED CASSAVA ROOTS.

"Results of trial shipment as per account sales.

<i>Cr.</i>			\$	c.	\$	c.
"By 11 bags dried cassava roots 1,457 lb. at \$35 per ton of 2,000 lb. ex rails, Toronto			...	...	25	50
<i>Dr.</i>						
"To Customs Entry...	...	...	...	1	00	
"Ocean freight...	...	...	...	3	58	
"Rail " 1,430 lb. at 38c.	...	...	...	5	43	
"Commission on \$25.50 at 2½ per cent....	...	...	...	64	10	65
Balance due	...	...	...	14	85	

Yields at Experiment Station, 1913:—

On banks at rate of 14,000 lb. per acre.

"flat " " 17,000 " " "

"17,000 lb. would give at 38 per cent. 6,460 lb. dried roots, or approximately three tons of 2,000 lb. gross value at \$35, \$105 (£21 17s. 6d.) per acre. Net value in Kingstown at \$21.72, \$65.16 (£13 11s. 6d.) 14,000 lb. would give at 38 per cent. 5,320 lb. dried roots, approximately 2½ tons of 2,000 lb. per acre—gross value, at \$35, \$87.50 or £16 4s. 6d. and net value in Kingstown at \$21.72, \$54.30 (£11 6s. 3d.) Average yield on estates 10,000 lb. 10,000 lb. would yield at 38 per cent. 3,800 lb. dried roots—gross value \$66.50 (£13 17s.). Net value at \$21.72, \$41.26 (£8 11s. 11d.)

"How net value in Kingstown of one ton was estimated. Value of one ton of 2,000 lb. in Montreal \$35.00 (£7 5s. 10d.)

Freight at 54c. per 100 lb. \$10.80

Customs entry... 1.00

Commission at 2½ per cent.... 88

Lighterage, etc.... 60

\$13.28 \$13.28 (£2 15s. 4d.)

Net value in Kingstown ... 21.72 (£4 10s. 6d.)

COMPARISON OF PRICES OF DRIED CASSAVA ROOTS AND CASSAVA STARCH.

"The following figures show that when cassava starch is selling at \$6.85 per barrel of 220 lb. in Trinidad, the value is on a par with dried cassava roots at \$35 per ton in Montreal. In other words, when cassava starch is selling at over 8c. per lb. in Trinidad, or over 2½c. per lb. in the Colony, it is more profitable to manufacture starch than to sell the dried roots.

"In this comparison no allowance has been made either for depreciation of machinery, or the difference in cost of labour in the preparation of the two products. Such allowance would need a more accurate estimate than I feel in a position to give, but would undoubtedly, at least in the matter of machinery, be in favour of the manufacture of the dried roots.

"The starch extraction by weight from the green roots is placed at 17 per cent., which is calculated from information given by local starch manufacturers. Details of calculations.

5,000 lb. green roots yield 2,000 lb. (1 Canadian ton) dried roots or 850 lb. starch.

"Therefore for the selling price to be on a par with dried roots at \$35 in Montreal (\$21.72 in Kingstown), the starch would realize \$6.85 per barrel of 220 lb. in Trinidad (\$5.60 per barrel in Kingstown).

"The net value of the starch has been calculated from account sales, the charges per barrel, when shipped to Trinidad, being as follows:—

<i>Cr.</i>				\$ c.	\$ c.
"By 1 barrel of cassava starch				6	85
<i>Dr.</i>					
To Freight .. ..	..	..	..	24	
„ Export duty .. ..	..	..	..	12	
„ Import „ .. ..	..	..	..	50	
„ Portorage .. ..	..	..	..	5	
„ Commission at 5 per cent. .. ..	..	..	..	34	1 85
Value in Kingstown					\$5 60."

CASSAVA IN REUNION.

The Monthly Bulletin of Agricultural Intelligence and Plant Diseases November, 1914, contains an article on "Agriculture in Reunion" abstracted from the *Ministère des Colonies, Bulletin de l'Office Colonial*, Year 7. No. 98, pp. 300-309, June 1914, in which it reports that the cassava crop "has increased greatly since 1892 when there were only three mills dealing with about 12 million pounds of manioc. At the present time there are 7 mills producing about 4½ million pounds of flour and tapioca from about 40 million pounds of tubers. During recent years dried manioc has been exported in small cakes containing 85 to 90 per cent. of flour. This product is used in France in the preparation of alcohol for liqueurs."

It also reports that the acreage under cassava has increased from 3,880 in 1892 to 8,650 in 1912, whilst the exports of tapioca and starch have increased during the same period from 654 tons to 2,037 tons. In 1912 there was also an export of 242 tons of dried cassava.

CASSAVA AS A CATCH CROP WITH COCONUTS.

In his recently issued book *The Coconut*, Professor E. B. Copeland, Dean of the College of Agriculture in the Philippines, discusses very impartially the question of catch crops in coconut cultivation. He argues that any catch crop must take something from the fertility of the soil, and that this by itself is bad for the coconuts. On the other hand coconut growing is a business, and the planter will prefer to grow another crop with the coconuts if thereby he can secure a greater profit. If labour conditions permit it will be found that under any reasonably good market

conditions, there are various crops which can be taken from the ground and made to pay some profit above the cost of raising them and purchasing manures more than sufficient to replace what they take from the soil, and "that their culture will keep the coconut plantation in better condition than can be expected if attention is devoted to the coconuts alone."

Professor Copeland insists that catch crops will prove unprofitable in the long run, even if they give immediate returns, unless manuring is practised; but, "if such a return is made, and in full measure, the coconuts will fare better for the operation; because the food of the catch crop is taken from the area between the coconuts, and the fertilizers can be applied more immediately by the neighbourhood of the young trees. And this is bound to result in their growing more rapidly than they would if they had all the ground to themselves, but were not helped to reach their food."

He then discusses the labour question and what should be done if catch crops are not employed; and instances a case in which as the result of keeping the ground cultivated, trees six years old were six inches more in diameter than those in a control plot, kept clean weeded, but without the ground being worked.

The conclusion the author draws is, "This is indeed a very striking result, and it may prove, as the trees produce, that the money spent in cultivation pays better returns than it would have done if used in planting and giving the merely necessary attention to a larger number of trees. It is my personal opinion that under most labour conditions, such care cannot profitably be given to coconuts, and I am sure that where it is practicable to this extent, it is advisable to raise catch crops."

The next point Professor Copeland deals with is that coconuts can be left to take care of themselves; after describing how such lack of proper care results in trees below the proper size, in delay in coming into full bearing and reduction of the crop when they reach full bearing, he concludes:— "In spite of the fact that a great many people treat their coconuts in this way, I do not believe that any who has observed the matter carefully enough to frame a sound opinion will hold that the money invested in such plantations has been used to the best purpose."

"Taking up now the other assumption, that a catch crop is to be cultivated, choice must be made among the various crops which in different places are used for this purpose. The catch crop must be one which does not need to keep the land for a long enough time to interfere with the development of the coconuts, or to have to be sacrificed when the coconuts need the whole of the ground. This is equivalent to saying that it must be a crop which can either be removed at the end of not more than three years, or which can endure being shaded after that time by the coconuts. In spite of the fact that it has already been advised that if any catch crop be grown a return of fertilizers be made to the soil to balance what the catch crop removes from it, it is advisable in choosing the catch crop to give the preference to one which is known not to make too heavy demands on the soil's fertility. For instance, tobacco, if at all intensively grown, makes very heavy demands on the fertility of the soil. In other respects it would be a valuable catch crop, but for this one reason it is not in general to be recommended. So far as possible, it is advisable

to give the preference to a catch crop which will be consumed on the ground, rather than to one which provides an article of commerce which contains in considerable quantity any mineral food; and a catch crop whose seed or grain only is sold from the plantation is better than one of which the whole plant is sold."

Professor Copeland then discusses the advantages and disadvantages as catch crops with coconuts, of rice, corn, abaca or Manila hemp (*Musa textilis*) and finally cassava or manioc, concerning which he says:—

"My own preference in the choice of a catch crop, if it is possible to utilize it, is manioc. Manioc is an exceedingly heavy producer and can be made to pay a very large return for the use of the land. This can be done either by feeding the roots to stock, which however can be recommended only with certain qualifications, and often only with certain treatment, or by using the roots for the manufacture of starch or alcohol. This is not the place to discuss these industries. They are distinct and separate from coconut culture, and must be understood both in their industrial and their market relations before they can safely be undertaken. Where market conditions are satisfactory, it is practically certain that the production of manioc starch or alcohol can be made in two crops to pay for the necessary manufacturing equipment, for the clearing of the land, planting of both crops, and the cultivation needed by the land, and the return of fertilizers, and still leave a good profit for the operation of establishing the plantation.

"There are various crops, of the garden rather than of the field with which this can be done on a small scale, but there is no other which makes such slight demands upon labour, nor which can safely be undertaken on so large a scale, the reason for the last statement being that the manufactured products from the manioc are not perishable, and are marketable on the world's markets.

"There is a superstition, or it might be more respectful to say belief, that manioc is an exceedingly hard crop on the soil. This is caused by the practice formerly common in the Malay Peninsula, of clearing land for manioc, and abandoning it, to return to grass or bush, after harvesting two or three crops. There is no doubt that land treated in this way deteriorates very rapidly. In the Philippines land is very commonly treated in exactly the same way, except that the crop temporarily raised on it is usually rice. Still nobody believes that rice is distinctly a hard crop on the soil; and neither, as a matter of fact is the manioc. The soil would deteriorate almost as rapidly if the rice or manioc were ploughed under and nothing at all taken away from the ground. Observation has given me considerable confidence in the opinion that the soil does not deteriorate as rapidly in manioc as it does in rice. This has little to do with the relative rate of removal of mineral food, but is simply because the manioc keeps the soil more nearly in what may be called its virgin condition."

W.G.F.

PRUSSIC ACID IN SWEET CASSAVA.

By PROFESSOR CARMODY, F.I.C., F.C.S.

[In view of the present interest in cassava the following paper has been reprinted from *The Lancet* of September, 1900.]

FRANCIS, one of my predecessors in the Trinidad Government Laboratory, was the first to point out that prussic acid was present in sweet cassava to a considerable extent. Francis's results have not received the attention which they deserved, probably because they were a direct but unconfirmed denial of statements repeatedly made by recognised authorities. There are very few recent editions of toxicological handbooks that make any reference to the results published by Francis. Even in standard reference works like that of Dr. Thorpe's *Dictionary of Applied Chemistry* it is stated that "the milky juice in the sweet variety is innocuous, whilst that in the bitter is highly poisonous."

The question is of importance from a toxicological point of view in those places in the tropics where cassava is used extensively as a food. For poisonous symptoms are not infrequently reported after a meal of sweet cassava; and as the two kinds of cassava—the sweet and the bitter—are so much alike as to be almost indistinguishable, the conclusion usually arrived at is that the bitter variety has been cooked in error.

My results fully confirm those of Francis as to the presence of hydrocyanic acid, although his average figures are somewhat higher than mine. This year has been an unusually dry one for Trinidad and a diminished supply of rain does affect the character of plant juices.

The method of analysis adopted by me differs somewhat from that of Francis. He grated 500 grammes of cassava into 500 cubic centimetres of water which was left for two hours in a well-closed vessel. It was next strained through a linen cloth into a flask which was then corked and allowed to stand until the starch subsided. 200 cubic centimeters of the clear liquid were decanted and distilled and the results obtained were multiplied by four for the total in 500 grammes. This calculation was based on the assumption that the original 500 grammes contributed 300 cubic centimetres of water—an assumption which is not far from the truth if the cassava is quite fresh. Francis also remarks that a slight loss occurred during the process of grating, and in a tropical laboratory this loss might be appreciable. I endeavoured to avoid this loss on the one hand, and the possibility of error through assuming that all cassavas contained 60 per cent. of water on the other, by taking the whole root, slicing it quickly, and allowing it to stand in water all night in a well-corked flask. The liquid was decanted in the morning and the whole distilled. The extraction with water was repeated a second and a third time. The slices effectually prevented the great disadvantages arising from the starch finding its way into the distilling flask, which Francis prevented by subsidence but which necessitated his distilling an aliquot part, this aliquot part being a definite volume of 200 cubic centimetres taken from an approximate total volume of 800 cubic centimetres.

* *Analyst*, April, 1877.

Francis does not appear to have made more than one extraction with water. I have made three in all cases and in some as many as five. I have found that with slices the second extraction yields as much, and sometimes more, than the first. I have repeated Francis's method of grating and find that a second extraction yields about half as much prussic acid as the first. It would appear from this, therefore, that Francis's results are not as high as they would have been had he made a second extraction. The figures obtained by Francis and myself are :—

					<i>HCN. per cent.</i>	
					<i>Francis.</i>	<i>Carmony.</i>
Mean	...	...	...	...	0·0168	0·010
Highest	...	...	...	...	0·0238	0·019
Lowest	...	...	...	...	0·0113	0·005

It will be seen from this that while my "lowest" percentage is much below that of Francis my "highest" is nearly the same as his. This establishes the truth of the statement made by Francis, "that the so-called *sweet* or harmless cassava not only yielded prussic acid, but the quantity obtained from it so nearly equalled that from the *bitter* that no line of distinction could be drawn between them," so far as it relates to the amount of prussic acid in the cassava; but I have discovered an analytical difference between the two kinds by means of which they can be satisfactorily distinguished.

This discovery arose in trying to avoid the difficulties caused by the presence of starch in the distilling flask. At first I placed the slices in the distilling flask, added water in one set of experiments, and passed steam through in another and collected the distillates. This failed in each case through the gelatinising action of the boiling water or steam on the starch. This starch being chiefly confined to the inner portions, in my next experiments I soaked the inner slices in water at ordinary temperature, decanted and distilled. The quantity of starch thus admitted into the flask was so small as not to interfere with the distillation. The skin and outer cortical layer, which together constitute about one-fifth of the total weight of the sweet cassava, could be placed direct in the distilling flask, and the distillation carried on satisfactorily. It was this separation of the parts for convenience in distillation that led to the discovery that in sweet cassava the prussic acid is located chiefly in the skin and outer cortical layer.

The following are some of the results obtained from fairly representative samples of sweet cassava :—

<i>Inner part.</i>		<i>Skin and outer cortical layer.</i>		<i>Inner part.</i>		<i>Skin and outer cortical layer.</i>	
<i>HCN.</i>		<i>HCN.</i>		<i>HCN.</i>		<i>HCN.</i>	
<i>per cent.</i>		<i>per cent.</i>		<i>per cent.</i>		<i>per cent.</i>	
0·006	0·033	0·004	...	...	0·024
0·008	0·014	0·010	...	...	0·080
0·015	0·033	0·004	...	...	0·042
0·008	0·031	0·005	...	...	0·038
0·011	0·020	0·003	...	...	0·034
0·008	0·032				

With bitter cassava the following results were obtained from representative samples :—

<i>Inner part.</i>			<i>Skin and outer cortical layer.</i>			<i>Inner part</i>			<i>Skin and outer cortical layer.</i>		
<i>HCN.</i>			<i>HCN.</i>			<i>HCN.</i>			<i>HCN.</i>		
<i>per cent.</i>			<i>per cent.</i>			<i>per cent.</i>			<i>per cent.</i>		
0·031	0·024		0·017	...	...	...	0·019	
0·034	0·012*		0·019	...	...	...	0·020	
0·021	0·025		0·016	...	...	...	0·024	
0·037	0·014*		0·017	...	...	...	0·020	
0·030	0·025		0·013	...	...	...	0·016	
0·014	0·013		0·032	...	...	...	0·035	

The general conclusions to be drawn from these results are : (1) that in sweet cassava the prussic acid is not uniformly distributed throughout the tuber, and that in bitter cassava it is uniformly distributed, or nearly so ; and (2) that this affords an analytical means of distinguishing between *sweet* and *bitter* cassava.

Cassava is cooked either by roasting the entire tuber (this removes all the HCN.) or by boiling. An important observation in connection with local methods of eating cassava is that the skin of the sweet kind is removed before boiling. The inner portion alone being cooked and eaten. This custom is no doubt the result of experience and accords with what science would now teach as a wise precaution. But, notwithstanding this removal of the skin, ill-effects are said to follow from the use of the inner portion if water is drunk sometime after a meal. This may now be accounted for in this way. It is shown in my experiments that whilst a first boiling removes a certain amount of hydrocyanic acid—all, in fact, that exists ready formed in the tuber—that a second addition of water and subsequent boiling removes a further portion. It would appear from this that cassava in a person's stomach would also develop an amount of prussic acid equivalent to that obtained in a second distillation and that the drinking of water would dissolve this and cause it to act more readily on the system. The total quantity would, however, be far below the minimum fatal dose and would only be expected to produce those unpleasant results occasionally reported. The question next arises—Is this second portion of hydrocyanic acid produced by fermentative changes, as is known to happen in the case of bitter almonds ; or is it part of that originally existing in the tuber and in some way protected from the solvent action of the first treatment with water ? It is possible that, with slices, the water would penetrate slowly to their interior, and thus produce a second yield of prussic acid ; and that if the cassava had been grated, as was done by Francis, the water would, within Francis's limit, dissolve the

* Exceptional.

whole of the acid. I have not found this to be the case, as the following experiment shows :—

SWEET CASSAVA.

Duration.				Half (408 gram- mes) sliced n/10 AgNO ₃ .	Half (427 gram- mes) grated. n/10 AgNO ₃ .
First extract	2 hours	...	...	3.0 c.c.	2.2 c.c.
Second	" 2	"	...	1.3 "	1.4 "
Third	" 20	"	...	3.5 "	1.4 "
Fourth	" 2	"	...	1.0 "	0.7 "
Fifth	" 2	"	...	1.0 "	0.9 "
Sixth	" 17	"	...	1.1 "	0.5 "
Seventh	" 2	"	...	0.4 "	0.7 "
Eighth	" 2	"	...	0.5 "	0.9 "
Ninth	" 2	"	...	0.2 "	1.3 "
Total	...	...	...	12.0 c.c.	10.0 c.c.

It would appear from this and similar experiments that the whole of the hydrocyanic acid cannot be removed from grated cassava by a two hours' extraction with water, and that there is apparently a loss of acid even when the grating is done under water. And, notwithstanding that my yield from slices is the higher of the two; Francis's results from a two hours' extraction are appreciably above mine. As already stated, this may be due to the exceptionally dry season. Next year I shall continue the experiments in order to clear up this difficulty. At present I am inclined to believe that part of the acid may be formed by fermentative change. If this be so, cassava starch on keeping would be likely to be more poisonous than when freshly prepared. Fermentation beyond a certain limit entirely decomposes the hydrocyanic acid.

There appear to be no grounds for the common belief that sweet cassava contains more HCN the older it is. In all the samples examined during a period of nine months from the time cassava was first brought to market, the proportion of HCN showed no increase that could be traced to age. Nor is there any ground for the belief that the locally grown sweet cassava is but a degenerate growth resulting from many years' association with the bitter variety. A selected sample imported from Jamaica and grown at the local Government gardens contained the same amount, and the same relative proportions in skin and inner part of HCN as the ordinary product of Trinidad.

The subject is not yet exhausted, and I hope to be in a position to publish further results next year.

BITTER AND SWEET CASSAVA—HYDROCYANIC ACID CONTENTS.

By A. E. COLLENS, F.C.S.,
Officer in Charge, Special Investigations.

A FAIRLY thick portion of the main stem of a bitter cassava plant was forwarded for the determination of the yield of hydrocyanic acid by hydrolysis on distillation and the following results were obtained :—

		<i>Hydrocyanic acid</i> <i>per cent.</i>	
Thick outer cortex or peel	0·057
Inner woody portion (central pith removed)	0·004
Central pith	0·035

As the sample was partially dried before the analysis was commenced, it was thought advisable to repeat the experiments, determining the yield of hydrocyanic acid obtained from different parts of freshly dug cassava plants. In this experiment the analyses were commenced immediately after the plants had been dug up; the following results were obtained :—

FIRST EXPERIMENT: FRESHLY DUG ROOTS.

		<i>Per cent. Hydrocyanic acid</i>		
		<i>Sweet.</i>	<i>Bitter.</i>	
<i>Top</i>	Full grown green leaves	...	0·0162	0·041
	Green stem where leaves branched off	...	0·0144	0·024
<i>Woody mature stem :</i>				
	Green cortex or peel	...	0·043	0·113
	Inner woody portion	...	0·0072	0·0027
	Central pith	...	0·019	0·076
<i>Root</i>	(Freshly dug up) Peel	...	0·0147	0·055
	Pulp (edible portion)	...	0·0048	0·053

Experiments were also conducted to ascertain whether the percentage of hydrocyanic acid was constant throughout the tubers or variable as the sugar contents of beet, etc. As the functions of cyanogenetic glucosides generally are supposed to be akin to the hormones or chemically active cell stimulants of the animal body, it was considered likely that there might be a greater concentration at the points of cell formation. The following yields were obtained from roots after being one day out of the ground :

		<i>Per cent. Hydrocyanic acid.</i>	
		<i>Sweet.</i>	<i>Bitter.</i>
Top ends (<i>i.e.</i> first four inches)	...	·024	0·0794
Intermediate portion (second 5 inches)	...	·022	0·094
Lower end (third 5·5 inches)	...	·0224	0·094

SECOND EXPERIMENT: AFTER THREE DAYS REMOVAL FROM GROUND.

		<i>Per cent. Hydrocyanic acid.</i>	
		<i>Sweet.</i>	<i>Bitter.</i>
Top half of root	...	0·0448	0·06
Bottom half ...	...	0·026	0·077

The sweet cassava roots were less matured than the roots of the bitter type. But the variation in the hydrocyanic acid contents is peculiar and further investigation on this point will be made. During the air-drying of the roots a loss of water takes place, especially in the cortex, and in consequence the hydrocyanic acid content is increased. The following data were obtained:

		<i>Per cent. Hydrocyanic acid.</i>			
		<i>Peel.</i>		<i>Pulp.</i>	
<i>Roots</i>		<i>Sweet.</i>	<i>Bitter.</i>	<i>Sweet.</i>	<i>Bitter.</i>
Fresh ...	...	0.0147	0.055	0.0048	0.053
One day old	...	0.0684	...	0.0082	...
Two days old	...	0.0594	0.205	0.0084	0.049
Three days old	...	0.0587	0.245	0.0120	0.1114

HYDROCYANIC ACID CONTENTS OF LIQUID EXPRESSED FROM BITTER CASSAVA.

	<i>Per cent. Hydrocyanic acid.</i>
by (1) Direct pressure in screw press	... 0.037
(2) Centrifugal action	... 0.040

In the above experiment twenty-four ounces of freshly dug up bitter cassava were rapidly ground and pressed. On analysis the following yields were obtained:

	<i>Per cent. Hydrocyanic acid.</i>
Whole root ...	... 0.0456
Liquid expressed	... 0.0370
Residual cake (wet)	... 0.0680
.. .. (after thorough air drying)	... traces.

HYDROCYANIC ACID—PRESENCE IN THE BOILED ROOTS.

Several experiments were carried out to prove whether the hydrocyanic acid was entirely removed by boiling the cassava roots as ordinarily conducted in the kitchen, or whether there was a possibility of any further production if the linamarin (phaseolunatin of Dunstan—the hydrocyanic acid yielding enzyme present in cassava) had not been entirely destroyed by boiling.

Sweet Cassava—Four large roots boiled and three (a., b. and c.) removed from the water.—HCN determined when cold—

- (a.) After lapse of 1 hour.—No HCN present.
 (b.) " " 2 hours. " "
 (c.) " " 24 hours. " "
 (d.) " standing overnight in water .0017 % present.

	<i>HCN contents.</i>			
	<i>after 1 hour</i>	<i>3 hours</i>	<i>24 hours</i>	
Large root—Plain boiled	...	nil	nil	nil
" Roasted	...	"	"	"
" Boiled and roasted	...	"	"	"
Water in which cassava had been boiled—after cooling—No HCN.				

Bitter Cassava—Water in which bitter cassava was boiled—No HCN.

Root boiled and tested for HCN when cold—002 per cent.

From the above experiments it is evident that if sweet cassava is properly cooked either by boiling or roasting that no hydrocyanic acid is developed even on allowing to stand for one day.

In the case of both bitter and sweet cassava if the roots are not properly boiled and are allowed to remain soaking in water for sometime, there is a possibility of a small amount of hydrocyanic acid being developed.

NOTE.—Much attention has been devoted at the Imperial Institute, London, to the question of the occurrence of hydrocyanic acid in various economic plants, including cassava. The *Bulletin of the Imperial Institute* should be consulted by those interested in this question.

ALCOHOL FROM CASSAVA.

By A. E. COLLENS.

THE following experiments were carried on at the Government Laboratory to determine the yield of alcohol obtainable from cassava:—

EXPERIMENT No. 1.

Five ounces of dried cassava slices were pulverised and boiled, then saccharified with powdered kiln-dried malt and the wash started at 1040. After 66 hours it had attenuated to 1015 and fermentation ceased. On distillation, 130 cubic centimetres of spirit 78·0 under proof (or 22 per cent. of proof spirit) were obtained. This corresponds to a yield of 27·3 gallons of 94 per cent. alcohol (64 over proof) per ton of slices.

The cassava used was some which had been dried nearly three years previously and had somewhat deteriorated. The fermentation was not very satisfactory being checked at 1015.

EXPERIMENT No. 2.

One pound of freshly dug up, slightly immature, sweet cassava roots were rapidly pulped, the starch and fibrous portion being boiled separately to prevent burning, then mixed and saccharified with malt until the liquid gave no blue reaction with iodine. The wash was then set up at 1017. After 40 hours it had attenuated to 1001 and was then distilled.

11 ounces of distillate were obtained at 79·8 under proof, *i.e.* 20 per cent. proof spirit, corresponding to 18·9 gallons of 94 per cent. alcohol per ton. Assuming the fresh tubers to contain 80 per cent. of water, this would correspond to a yield of 75·6 gallons per ton of dry material.

EXPERIMENT No. 3.

One pound thirteen ounces of cassava roots, purchased in the open market, after grating and boiling, were saccharified with taka diastase; the fermentation being started at 1035. After 26 hours the gravity of the wash had fallen to 1008 and was finally distilled at 1005.

The wash yielded 1,200 cubic centimetres of distillate containing 16·8 per cent. proof spirit, equivalent to a yield of 82·6 gallons of 94 per cent. alcohol per ton. Assuming the sliced root to lose 60 per cent. of its weight on air drying, this would correspond to a yield of 81·5 gallons per ton of air dried slices.

COMPOSITION OF STEM OF BITTER CASSAVA.

			<i>Per cent.</i>	<i>Calculated on material dried at 100° C.</i>
Water ...	...	...	11.10	...
Ash ...	...	...	3.00	...
Ether extract ...	...	...	1.60	...
<i>a</i> Hydrolysis loss...	...	...	51.25	57.65
<i>b</i> „ „ ...	...	...	55.20	62.09
Mercerisation loss...	...	...	54.90	61.75
Nitration at 60° F...	...	...	0.65 gain	0.73
Acid purification ...	...	...	29.30 loss	32.95
Cellulose ...	...	...	33.15	37.29

The per cent. of cellulose is low compared with that derived from the crude material of wood pulp (poplar, &c.)

March 1, 1915.

(Sgd.) A. E. COLLENS,
Acting Principal Asst., Govt. Analyst.

FORESTRY.

NOTES ON DIRECT SOWING OF SEEDS OF TIMBER TREES IN PLANTATIONS.

By C. S. ROGERS, Forest Officer, Trinidad and Tobago.

TIMBER trees grown from seeds at the spot where they are to remain will as a rule flourish better and produce finer timber than those that have been transplanted from nurseries or from the forests, and for this reason, it is recommended that seeds of cedar (*Cedrela odorata*), cypre (*Cordia gerascanthus*), balsam (*Copaifera officinalis*), and teak (*Tectona grandis*) should be sown at stake or picket. It would however be better as a general rule to supply vacancies, due to failure of seeds, with young transplants than to wait another year.

To ensure a good stand, not less than five seeds should be sown at a picket; in the case of balsam, two or three are sufficient, the seeds being evenly distributed round the picket and at about six inches from it. When more than one plant results, the surplus can be used as transplants to supply vacancies without injury to the plant left.

The planting spots should be about two feet to thirty inches across and should be cleared of all weeds and the soil well broken up and made quite fine.

Small seeds, such as cedar and cypre, should be covered with not more than half an inch of fine soil; balsam and teak may be covered with one inch. Seeds should be sown in the position in which they would naturally lie if dropped on the ground.

Sowing is best done after rain, but seeds will keep fresher, even in dry weather, if covered with a thin layer of fine soil than if kept in store.

It is of great importance that seeds, with the exception of teak, should be sown when quite fresh. It has been found that 80 per cent. to 95 per cent. of cedar seeds will germinate within a fortnight in moist soil when sown within a month of collection and 76 per cent. after three months. At six months the seeds are worthless.

Cypre seeds sown at pickets as soon as collected, produced 90 per cent. success, and one month after collection, 46 per cent. germinated. At three months old they would probably be useless.

Balsam seeds will keep for two or three months, but give best results when quite fresh.

Teak seeds will as a rule germinate better when one year old than when quite fresh, and it has been found that when sown fresh, a far larger proportion grow in the second year than in the year they are sown.

Three or four weeks after the first sowing, if rain has fallen, a second sowing should be made at the pickets at which no plants have grown to reduce the proportion of transplants necessary. Even in the case of teak, a second sowing is recommended; any surplus plants not required as supplies may be cut out. In dry weather count the weeks from the first rain.

In addition to the re-sowing, one or more nurseries should be made in or near the plantation from which supplies can be obtained as required. These nurseries should be sown at the same time as the plantation. The seeds in the nurseries may be sown two or three together at spots one foot apart in rows, the rows being two feet apart.

A distance of ten feet by ten feet is recommended for a timber plantation, for, although the trees cannot grow to full maturity so close together, they will be forced to form straight trunks and thinnings can be made as necessary.

MONGOOSE.

IN accordance with the recommendations of the Entomologist (*Bulletin* xiii. 1914, p. 196), which were adopted by the Board of Agriculture, the Government has issued and distributed a placard in the following terms :—

NOTICE.

Mongoose Pest.

It is notified for general information that in future no premiums will be paid by the Government for mongoose caught either on private or Crown lands.

The duty of destroying mongoose is regarded as falling within the province of the occupier or owner of lands as is the case with squirrels, rats, or other destructive animals. The co-operation of all is urgently requested, as it is only by united action that this pest can be controlled.

DIRECTIONS FOR DESTROYING MONGOOSE.

(1.) Mongoose can be destroyed by hunting them with dogs trained for the purpose, and by trapping them.

(2.) Any good make of jaw traps can be used, and models that have given good results can be seen upon application at the Warden's Office. Native fly traps can also be used.

(3.) In places where mongoose are common, their runs, which are similar to those made by rats, can easily be found and it is in these that the traps should be set.

(4.) As bait use smoked herring, fat pork, shrimps, fish entrails, and parts of fowls and eggs. All baits are more attractive when in a state of decomposition. The contents of rotten eggs are most useful to remove any odours that may be left on traps and baits after handling. After setting apply rotten egg by means of a brush or feather to the trap and bait.

(5.) The best time of the year for trapping is during the dry season ; mongoose go about during the day only, and traps should be set between the hours of 8 a.m., and 6 p.m. Localities principally frequented by mongoose are tall grass and bush near villages and estates, high canes, and abandoned sugar-cane lands over grown with scrub and grass.

Well illustrated details, in connection with the mongoose and its destruction, have been published in *Circular No. 12*, of the Board of Agriculture, which may be had free of charge upon application to the Director of the Department of Agriculture, or to the Secretary of the Board of Agriculture, Port-of-Spain.

(Sgd.) S. W. KNAGGS,
Colonial Secretary.

Government House,
December, 1914.

BOTANICAL.

ORCHIDS IN FLOWER JANUARY 1915.

THE orchid collection of the Gardens, owing to various circumstances had become reduced to very small proportions, but a beginning has been made to get together a fresh collection and this is now in the new Orchid House in Government House Gardens. is proposed to issue regularly in the *Bulletin* a list drawn up by Mr. W. E. Broadway, of the orchids in flower during the preceding month. This will be of service in gradually compiling an authentic record of the flowering seasons of the various species and of the growth of the collection.

<i>Brassavola nodosa</i> (L.) Lindl.	...	..	Central America and Jamaica.
<i>Cattleya Skinneri</i> Lindl. var. <i>parviflora</i> Hook.	...		Trinidad.
<i>Coelogyne pandurata</i> Lindl.	...	...	Malaya.
<i>Diacrium bicornutum</i> (Hook) Benth (<i>Epidendrum bicornutum</i> Hook).	" Virgin Mary [Orchid]"	...	Trinidad and Tobago.
<i>Dichæa graminoides</i> (Sw.) Lindl.	...	...	" "
<i>Epidendrum ciliare</i> L.	" Spider Orchid "	...	Trinidad.
<i>Gongora quinquenervis</i> Ruiz et Pav. (<i>G. maculata</i> Lindl.)	" Jack-spaniard [Orchid]"	...	"
<i>Lockhartia acuta</i> (Lindl.) Rehb. f.	...	...	"
" <i>elegans</i> Hook.	...	...	"
<i>Oncidium papilio</i> Lindl.	" Butterfly Orchid "	...	"
" <i>Lanceanum</i> Lindl.	" Cedros bee "	...	"
" <i>Sprucei</i>	...	...	"
" <i>ampliatus</i> Lindl.	Yellow bee "	...	"
<i>Scaphyglottis prolifera</i> (R. Br.) Cogn. (<i>Ponera prolifera</i> Rehb. f.)	...	...	Trinidad and Tobago.
<i>Spiranthes acaulis</i> (Smith) Cogn. (<i>S. picta</i> Lindl.)	...	...	" "

NURSERY WORK.

Plants sold and distributed from St. Clair Experiment Station.

APRIL 1 TO DECEMBER 31, 1914.

	Sold.	Distributed in exchange or gratis.
Avocado pear, budded	8	—
Cacao "	307	4
" seedling	27,919	14
" grafted	150	5
Coffee, Robusta	17,210	50
" Other varieties... ..	4,276	—
Citrus, budded	236	—
" seedling	252	8
Decorative Flowering	736	201
" Foliage	392	91
Ferns	207	11
Line	8,542	—
Mango, grafted	578	24
Miscellaneous fruits	1,648	347
Miscellaneous	1,892	206
Orchids	—	665
Palms	1,310	78
Rubber	316	1
Spices	190	88
Shade	1,043	526 *
Timber	664	5
	67,811	2,324

* 500 Gliricidia cuttings.

Seeds.

	Sold.	Distributed.
Coffee, Robusta	56 lb.	—
" Other varieties	16½ "	—
Countable seeds	24,218	8,604
Packets "	55	121
Pods	6	20

The receipts for the same period amounted to £682 19 5½, as compared with £392 11 7 during April to December 31, 1913.

PLANT DISEASES AND PESTS.

MYCOLOGICAL NOTES.

SPRAYING OF CACAO, COCONUTS AND CASSAVA.

At the December meeting of the Board of Agriculture Mr. J. B. Rorer reported that since the November meeting the second application of Bordeaux mixture had been made to the trees in the experimental plot at Caparo, and two more applications to the cassava plots at St. Clair.

He had visited the sprayed plots at Toco last week, and the pickings there were beginning to be heavy; so far, the sprayed trees have yielded about three pods more per tree than the unsprayed trees. The pickings to be made in January should show still more marked differences between the sprayed and unsprayed trees. The experiment which has been carried on at Toco for the control of coconut bud rot promises to give marked results by the end of another year. So far, but one of the sprayed trees which had the disease at the time spraying was begun has died, whilst a number of adjacent trees which were not sprayed have already become so badly diseased that they have had to be destroyed.

A further report was made in January when Mr. Rorer said:—

Since the last meeting I have again visited the sprayed plots of cacao and coconuts at Toco. Although it is too soon to give the full results from these plots, so far, the spraying is showing up well. There has been no increase in yield of cacao from the sprayed trees over the unsprayed, but the percentage of black cacao has been reduced by over half, and it is possible that the pickings of this and next month will also show an increase in number of pods; in fact, this beneficial effect of spraying is generally noticed in the pickings made from 4 to 6 months after the applications of Bordeaux mixture. The trees at Toco were sprayed on September 9 and October 20, therefore, I expect to see an increase in number of pods in the next few pickings.

In all, about 100 coconut trees have been sprayed at Toco, and so far, only one of these trees has died from bud rot, and it was probably infected before the spraying was begun. Sixteen adjacent unsprayed trees have died from the disease since the middle of last year. The trees which have been sprayed ranged from 3 to 15 years old, and we have had no difficulty in doing the work; where the trees are too tall to be reached from the ground, a ten foot ladder has been used.

The spraying of the cassava plot at St. Clair has been continued. So far, there is no very marked difference between the two plots, though the sprayed plants seem to be in a little better foliage.

ENTOMOLOGICAL NOTES.

CACAO BEETLES AND THIRPS.

Mr. F. W. Urich dealt with cacao beetles and thrips in his report to the Board of Agriculture in December and January. In December he reported that since the November meeting he had paid a visit to the Moruga and La Lune districts which as he had reported previously, were suffering considerably from the attacks of cacao beetles. He was glad to state that on this occasion he found that remedial work was going on in more places than on his former visits, but many of the planters complained that some of their neighbours did nothing and so spoilt the effect of their work. The work undertaken consisted of spraying and cutting out the larvæ. On one estate 63,000 larvæ and 5,000 beetles were caught from January to December 1914.

In connection with thrips an experiment was tried of dusting 1,000 cacao trees with a mixture of one part flowers of sulphur mixed with ten parts of air slaked lime. The mixture was applied by means of Furt dusters, and in order to give it a better chance of sticking to the leaves the work was carried out early in the morning. Although some of the insects were killed many survived, and he did not consider that dusting can be used with success against thrips.

At the January meeting Mr. Urich said :

Since the last meeting of the Board he had visited Sangre Grande district in connection with thrips. On one of the estates there were indications that thrips had been present about a month before, but not in sufficient numbers to do damage. Fields that had been well drained and to which pen manure had been applied were free from thrips. On another estate thrips had done some damage in small patches, but at the time of his visit, which was at a very rainy period, there were very few insects to be seen; a more severe attack was no doubt warded off by the rainy weather in December. It is possible that if a change of leaf occurs when the dry season commences, thrips may give trouble if not taken in hand early.

On an estate in the heights of Arima, cacao beetles were troublesome in a few isolated places exposed to sun and wind. Young trees which had been supplied a few years ago appeared to suffer most from the attacks of the beetles. It might be well to spray or paint these supplies twice a year with a solution of arsenate of lead.

COCONUT BUTTERFLY.

At Chaguanas an outbreak of caterpillars of the coconut butterfly (*Brassolis sophora*) did some damage to young cultivation. This attack was no doubt due to the absence in that district of the natural enemies, of which there are several in Trinidad. Owing to the habits of the caterpillars in congregating in nests during the day, their control in connection with small trees is comparatively easy, as they can be collected by hand and burnt. Attacks of this caterpillar in Trinidad are sporadic, and as a rule they do not last long.

CACAO BEETLE DECLARED A PEST.

THE Board of Agriculture at the meeting in January 1915 unanimously agreed to recommend that the cacao beetle be declared a pest under the Plant Protection Ordinance.

His Excellency the Governor has since issued a Proclamation, No. 7 of 1915, declaring the cacao beetle to be a pest within the meaning of the Ordinance. The Proclamation is published in the *Royal Gazette* for February 4, 1915, p. 174.

LOCUSTS.

In a letter from Ciudad Bolivar, Venezuela, dated January 19, 1915, Mr. Robert Henderson writes :—

“As I think it might be of interest to you, I am writing to tell you that on the 15th inst. we had an invasion of locusts. They began to come in the morning and by the afternoon whole swarms of them had invaded the place. They came flying low, making a noise like a waterfall. They came from the south-west and flew in a north-easterly direction. Very few alighted on the trees and at dark they were gone—I hope they haven't gone your way. The Black birds—called here “torditos”—which are also to be found in the outlying districts of Trinidad, flew at them and chased them; they would dive down on them fall back and then attack again.

“It is a pity there is such an indiscriminate killing of these birds in Trinidad by the ragamuffins (and others who ought to know better), as I am informed by our Manager at Forres Park that they aid very materially in destroying the insect pests that do so much harm to the young canes.”

Mr. Henderson sent a few specimens of the locust on which Mr. Urich, the Entomologist, reports as follows :—

“The locusts received are a species of *Schistocerca* to which genus belongs the true migratory locust described in Biblical history. In Trinidad we have a species of *Schistocerca* in the cane fields. It is never very numerous but occasionally the eggs escape destruction by natural enemies, and the young insects have been known to eat off from 10-12 acres of canes. Attacks of this kind are rare. Trinidad locusts are affected by the green muscardine fungus and it is possible it may destroy the Venezuelan species as well. If any one in Venezuela would like to try experiments in this direction we would be glad to supply a pure culture of this fungus.”

NOTES.

Mr. J. C. Augustus has resigned from the posts of Curator of the Royal Botanic Gardens, Trinidad, and Superintendent of River Estate in order to take up the position of Manager of the Palmiste group of estates, the property of the Hon. Sir Norman Lamont, Bart.

Mr. V. A. Renwick of the Department of Agriculture has been appointed, by His Excellency the Governor, Assistant Inspector under the Plant Protection Ordinance. He took up his duties on March 1. 1915.

The Agricultural and Industrial Exhibition of the Agricultural Society was held on February 26, 27 and 28. The quality of the exhibits in almost all sections was very good. Notes on some of the chief features of interest will appear later.

Throughout the greater part of the Colony January 1915 had a much heavier rainfall than January of last year.

The Annual Agricultural and Handicraft Exhibition for Elementary schools in Port-of-Spain and neighbourhood was held at the Royal Victoria Institute on Thursday, March 25. The practical competitions in forking and layering were carried out at St. Clair Experiment Station.

Increased attention is being given to sugar cultivation in Tobago and on one estate the old mill is being repaired.

The following notice has been issued by the Government Veterinary Surgeon, in the *Royal Gazette* and the public press:—

"It is hereby notified for general information that Anthrax and Pleuro Pneumonia Contagiosa diseases exist in British Guiana, and all animals arriving from British Guiana will, under the provisions of Ordinance 158, be detained subject to vaccination with anthrax vaccine, at the expense of the importer.

"On account of the disease Pleuro Pneumonia Contagiosa, cattle from British Guiana will be permitted to land only at Port-of-Spain Quarantine Station for Animals for slaughtering purposes."

RAINFALL RETURN FOR JANUARY, 1915.—CONTD.

Stations.	January, 1915.	January, 1914.
<i>San Fernando and Princes Town</i>	<i>Ins.</i>	<i>Ins.</i>
<i>District.—(Cont'd.)</i>		
Naparima—Lewisville, San Fernando..	6.34	1.46
„ Tarouba estate ..	8.39	0.95
„ Union Hall „ ..	3.52	1.14
„ Palmiste „ ..	4.58	0.86
„ Hermitage „ ..	4.81	0.78
Princes Town—Craigish „ ..	5.83	1.45
„ Cedar Hill estate ..	4.60	1.94
„ Williamsville estate ..	6.29	3.02
„ Esmeralda Estate ..	6.57	2.94
„ New Grant estate ..	8.49	2.44
„ Constabulary Station ..	3.54	0.98
„ Hindustan estate ..	6.35	1.61
„ La Retraite estate ..	9.12	1.70
„ Malgretoute estate ..	5.19	1.55
Savana Grande—Friendship and Ben Lomond estates	5.77	1.35
Poole—El Rosario estate ..	7.35	1.79
<i>South-west District.</i>		
Oropuche—Constabulary Station ..	4.76	0.85
„ Pluck estate ..	6.08	0.34
Siparia—Constabulary Station ..	6.42	2.15
„ Alta Gracia ..	4.82	0.75
Guapo—Adventure estate ..	3.64	0.75
Cap-de-Ville—Constabulary Station ..	4.77	1.69
Erin—La Ressource estate ..	4.72	2.23
„ Industry estate ..	4.01	2.86
Cedros—Constabulary Station ..	3.05	1.97
„ Perseverance estate ..	3.27	1.78
Icacos—Constance estate ..	2.75	1.24
Iroia—Irois estate ..	5.78	2.17
<i>South Coast.</i>		
Moruga—Constabulary Station ..	4.02	1.18
<i>East Coast.</i>		
Matara—La Juanita estate ..	3.53	2.20
Manzanilla—Constabulary Station ..	6.15	2.82
Sangre Grande—Sta. Estrella estate ..	4.91	4.22
„ New Lands estate ..	8.82	3.55
„ Evasdale estate ..	6.27	3.12
„ Grosvenor estate ..	5.98	2.55
Mayaro—Constabulary Station ..	6.21	1.72
<i>North Coast.</i>		
Blanchisseuse—Constabulary Station ..	4.50	1.58
Grande Rivière—Mon Plaisir estate ..	3.10	2.60
Toco—Aragua House ..	4.78	2.23
„ Constabulary Station ..	3.27	1.74
Point Galera—Light House ..	1.65	0.59
<i>Tobago.</i>		
Tobago—Hermitage estate ..	3.80	3.29
„ Riversdale „ ..	3.66	1.33
„ King's Bay „ ..	4.80	3.46
„ Roxburgh „ ..	6.73	3.49
„ Lure estate ..	6.25	4.55
„ Botanic Station ..	4.02	2.23
„ Government Farm ..	2.60	0.98
„ Lowlands estate ..	3.69	0.98
„ Friendship estate ..	3.80	1.46
„ Bon Accord estate ..	2.95	...

AGRICULTURAL EDUCATION.

EXAMINATION FOR AGRICULTURAL PUPILS.

A competitive examination for six places as Agricultural Pupils will be held on Wednesday, June 9, 1915.

The subjects of examination will be: Reading, Writing, Arithmetic and Elementary Agricultural Knowledge.

Candidates must not be less than sixteen years of age, and before the examination each must furnish a certificate of good character from the Head Master of his last school and one other responsible person.

The six successful candidates will each be awarded an exhibition of £8 per annum, for two years, provided their work and conduct are satisfactory and that they pass the prescribed examination at the end of their first year. They will whilst in training receive in addition pay on the ordinary estate scale for their work.

Before commencing as a pupil each of the six successful candidates will be required to furnish a medical certificate that he is physically fit; if medically disqualified his exhibition will pass to the next on the list.

At the end of the second year's training there will be offered for competition amongst the six pupils, three further exhibitions of £20 each for one year to be held on an approved estate outside the Department, subject to satisfactory reports from the managers of these estates.

Applications to sit for the examination must be made on or before May 20, 1915, on a form which can be obtained from the Assistant Director of Agriculture, St. Clair Experiment Station.

(Sgd.) P. CARMODY,
Director of Agriculture.

(Bulletin, Department Agriculture, Trinidad & Tobago, pp. 27-68. Issued Mar. 31, '15).

ULLETIN
OF THE
DEPARTMENT OF AGRICULTURE,
Trinidad and Tobago.

PART 3.]

1915.

[VOL. XIV.]

SUGAR.

**REPORT OF THE SUGAR COMMITTEE OF THE BOARD
OF AGRICULTURE ON THE POSSIBLE EXTENSION
OF THE SUGAR INDUSTRY OF THE COLONY.**

¶ HIS report is the outcome of a letter dated October 6, 1914 to His Excellency the Governor from the Secretary of the West India Committee in which it was pointed out that "in view of the high prices which consumers in the United Kingdom are now paying as the result of their dependence on the Continent of Europe, and especially on Germany and Austria, for the bulk of their supplies of sugar in the past, the question as to extending Great Britain's sources of sugar supply within the Empire is bound shortly to be raised."

The Committee asked to be informed what room there is for the expansion of the sugar industry in Trinidad, and for figures showing (a) the actual acreage suitable and available for cane sugar cultivation; (b) the approximate amount of sugar which the Colony would be capable of providing with its existing labour supply.

The letter was brought before the Board of Agriculture on October 21, and it was decided that the authorities of the chief sugar estates should be asked to supply the information desired and that their replies should be considered and reported on by the Sugar Committee which is constituted as follows:—

Prof. Carmody, Director of Agriculture (Chairman), Hon. Sir Townsend Fenwick, K.C.M.G., Hon. W. G. Kay, Messrs. J. W. Arbuckle, J. Black, W. G. Freeman, J. McLeod, J. B. Rorer, and C. F. Todd.

The following is a summary of the replies received from the various estates, denoted by the letters A., B., &c.:—

A.—Inquires what price would be guaranteed.

B.—The labour supply is dependent on rate of wages; with sugar selling at a lucrative price labour would probably be attracted from other colonies but much more could not be done with the existing supply. Extension of the industry would necessitate investment of fresh capital, which would not be forthcoming without an assurance by the Imperial Government of a preference for Colonial sugar.

C.—The acreage in Naparima could be increased by perhaps fifty per cent. if the labour supply and future market price permitted such extension. The present labour supply is inadequate for the existing area and forms the most serious drawback to extension.

- D.*—The proprietor has about 1,000 acres of uncultivated lands available but does not regard any great extension in the Colony possible with the existing labour supply.
- E.*—It is expected to make 9,000 tons of sugar in 1915, an increase of 1,500 tons on last year's crop. The higher prices this year will only serve to recover previous losses, and without a guarantee from the Imperial Government of better treatment at the end of the war the estates may not be able to continue to produce sugar. With a guarantee of Colonial preference a further extension of 4,000 tons might be expected but this would necessitate large outlays of capital. Sufficient labour would be forthcoming with continuation of present immigration facilities.
- F.*—The sugar area of the estate is being reduced by the planting of coconuts and limes. The Colony is capable of producing 60,000 to 70,000 tons with the existing labour supply. More cane farmers will be forthcoming so long as prices are remunerative.
- G.*—The only bar to increased production is the uncertainty as to the market. With a guarantee of price the company would probably extend the cultivation and equip the factory accordingly.
- H.*—The estates have 8,000 acres in cane and could add 1,000. with existing labour supply, provided sale of Crown lands is not reopened. This addition would necessitate capital outlay, which would scarcely be forthcoming without guarantee of remunerative price.
- I.*—The estates produce 8,000 tons, but have land to produce 7,500 or probably 8,000 tons. The existing labour supply in the district prevents such expansion. During recent years sugar prices have been unsatisfactory and the sugar area of the estates has been reduced, coconuts having been planted. With a guarantee as to price the company would extend cane cultivation, and improve the factory accordingly.
- K.*—Material extension of cultivation is not possible with existing labour supply nor expansion of factory without assurance as to the attitude of the Imperial Government to Colonial sugar after the war.
- L.*—About 500 acres on estate available for extension with existing labour supply, but no likelihood of their being cultivated at the prices paid for canes in recent years. Considerably higher prices necessary before cane farming will attract those who employ labour.

The war offers no sound grounds for extension of the industry, cane taking 15 months to grow, whilst beet requires only six months for growth and manufacture. The close of the war will see an immediate revival of the beet industry and reduced purchasing power of all nations. The opening of the Panama Canal will lead to an enormous increase in cane cultivation in Peru and possibly other Pacific countries. The present time is therefore unfavourable for extension in the British West Indies.

M.—Estimates that in neighbourhood of the estates there are about 12,000 acres suitable for sugar cane of which about half is now in this crop. The Colony with existing labour supply, including continuance of immigration on scale of last few years could produce very little, if any, more sugar than at present. Diminution in immigration, and transfer of lands to cane farmers would decrease present output. Additional capital outlay is dependent on assurance of reasonable profit. A moderate amount of preference for Colonial cane sugar in the British market would place the West Indian sugar industry in the position of a stable, if not highly remunerative industry in normal times.

The following is a summary of returns furnished to the Government by the Wardens as to the areas of the Sugar estates in each Ward Union, distinguishing, as far as information is readily available, between Sugar estates now in cultivation and those abandoned.

- (1.) *Arima*.—Five Sugar estates, in two groups. In the first group 300 acres in cultivation and 80 acres abandoned. In the second 1,041 acres available for cultivation; whether actually cultivated or not is not stated.
- (2.) *Blanchisseuse*.—No Sugar estates.
- (3.) *Cedros*.—No Sugar estates.
- (4.) *Couva and Chaguanas*.—Five estates or groups with total cultivated area of 12,991 acres. There are also 8,372 acres on these estates and elsewhere available and suitable for sugar.
- (5.) *Manzanilla*.—No Sugar estates.
- (6.) *Mayaro*.—No Sugar estates. Sugar cultivation has been abandoned some 50 years, and coconuts, cacao and coffee largely substituted. In addition to Crown lands there are about 2,000 acres available for Sugar cultivation.
- (7.) *Montserrat*.—Three Sugar estates, with an area of 666 acres. The area of the uncultivated portions is not easily ascertainable, but it will not be large during the next two years unless a fall in the price of sugar arrests activities.
- (8.) *Naparima*.—There are 11,122 acres now in Sugar cultivation and 5,874 available or suitable for sugar.
- (9.) *Oropuche and La Brea*.—Six Sugar estates with an acreage of 3,555. One of 597 acres in sugar, the others under cultivation in cacao, coconuts with a small amount of cane farming.
- (10.) *St. Ann's and Diego Martin*.—There are about 400 acres now in sugar, and some 800 acres in addition were formerly under sugar.
- (11.) *Savana Grande and Moruga*.—Seventeen Sugar estates, or groups of estates. Total acreage 11,446 of which 3,046 cultivated by estates and 2,921 by cane farmers, leaving a balance of 5,499 available for cultivation.
- (12.) *Tacarigua*.—Nine estates or groups, with total cultivated area of 9,480 acres, and 3,856 acres available for sugar.

(13.) *Tobago*.—Sugar is cultivated on sixteen estates only, having an aggregate area of 8,854 acres. Formerly there were 90 to 100 Sugar estates, but these are now largely in cacao and coconuts, and on the sixteen on which sugar is still grown coconuts are being largely interplanted amongst the canes.

(14.) *Toco*.—No Sugar estates. There are about 5,000 to 6,000 acres of forest land available for sugar, but roads, &c., are lacking.

These returns indicate that in Trinidad there are 42,514 acres in Sugar cultivation, and 80,981 regarded as available for sugar. The Tobago return does not show what proportion of the 8,854 acres is actually in sugar.

The sugar production of the Colony during the last twenty years, 1895–1914, taken from the statements prepared by the Hon. Collector of Customs, for the Canada West Indies Royal Commission (1910), and subsequently from returns published annually by the Secretary of the Agricultural Society is given in the following table:—

YEAR.				PRODUCTION (tons.)
1895-6	...	...	...	69,595
1896-7	...	...	...	59,678
1897-8	...	...	...	54,933
1898-9	...	...	...	58,109
1899-00	...	...	...	58,837
1900-01	...	...	...	46,277
1901-02	...	...	...	60,880
1902-03	...	...	...	57,880
1903-04	...	...	...	47,778
1904-05	...	...	...	50,774
1905-06	...	...	...	48,219
1906-07	...	...	...	50,000
1907-08	...	...	...	50,564
1908-09	...	...	...	49,933
1909	...	...	...	52,973
1910	...	...	...	51,950
1911	..	...	...	46,718
1912	...	...	...	40,936
1913	...	...	...	42,331
1914	...	...	...	55,488

The reduction in 1912 and 1913 was due largely to drought and frog hopper attack; in 1914 with more normal climatic conditions and diminution in pests there was a marked recovery, the crop being the greatest since 1902-03.

During this period of twenty years the average annual sugar crop of the Colony has been 52,715 tons. The average for the eight years immediately preceding the abolition of bounties in September, 1903, as the result of the Brussels Convention of December, 1902 was 58,267 tons, and for the twelve years which have followed the abolition of bounties 49,014 tons.

An important factor which must be taken into account has been in operation during recent years; that is the substitution of canes by other and more profitable crops. Coconuts, and to a less degree limes and cacao, are being planted on former sugar lands on some of which canes are still cultivated as a subsidiary crop.

On the other hand there was a marked extension in cane cultivation during 1914 on the Waterloo group of estates. Greater attention is also being paid to the selection of cane plants and to improved methods of cultivation.

As the result of the consideration of the replies summarised above and the other information available the Committee is of opinion that no material extension of the sugar industry is to be expected under present conditions, and that a continuation of immigration on the scale of the last few years is necessary for the maintenance of the present normal output.

The Committee is also of opinion that apart from the question of labour the dominant factor in any possible increase of the industry is the working capacity of the factories. To increase this and to provide additional encouragement for cane farmers, fresh capital is absolutely necessary. This would not be forthcoming without a guarantee that the market prices of sugar would be higher than during recent years. The only way in which this guarantee could be secured appears to the Committee to be that a preference should be given by the Imperial Government to sugar produced in the British Empire.

Adopted by the Board at a meeting held on March 19, 1915.

(Sgd.) P. CARMODY,
(Chairman).

CACAO.

REPORT ON EXPERIMENTS FOR THE YEAR SEPTEMBER 1, 1913, TO AUGUST 31, 1914.

By J. DE VERTEUIL, F.C.S.,
Superintendent of Field Experiments.

River Estate.

MANURIAL, SHADE, CHUPON AND NATURAL YIELD PLOTS.

ALL the plots have been treated respectively in the same manner as in previous years. Mulching has cost about \$6 (£1 5 0) less per acre than previously but is still a very expensive operation. The manures were applied broadcast to within three feet of the trunk of each tree, about two feet from the edge of the drains and the soil forked to a depth of about six inches. The control plots were also forked but no manures added. On plots which received basic slag, sulphate of potash and sulphate of ammonia, the sulphates of potash and ammonia were applied two months after the slag.

Throughout this report the age of the trees given is the approximate age during the first year of the experiments. In calculating the results recorded in the various tables it has been assumed that twelve pods produce a pound of dry cacao and the value of the marketable produce has been fixed at eleven cents (5½d.) per pound.

The rainfall registered on the estate for the twelve months from May 1, 1913 to April 30, 1914 was 62·86 inches, which is about four inches less than last year, but weather conditions have been very favourable, the precipitations being evenly distributed and the dry season preceding the crop was comparatively mild. Not only do the plots show a large increase over previous years but the output of cacao for the Colony is the largest on record. The fundamental importance of a favourable season is seen at a glance at most of the diagrams, the increase in crop over that of last year being in several cases as great in the no manure (or control) plots as in those under manurial treatment.

The monthly rainfall registered at River estate during the past four years is given below.

		1910-11	No. of days Rain fell.	1911-12	No. of days Rain fell.	1912-13	No. of days Rain fell.	1913-14	No. of days Rain fell.
May	...	5.38	16	0.55	6	4.09	17	2.32	9
June	...	8.96	21	10.93	27	7.71	24	6.05	19
July	...	8.29	16	8.17	22	12.96	24	5.91	18
August	...	10.72	23	15.35	26	7.79	23	16.10	24
September	...	6.90	20	7.09	20	9.16	21	11.14	22
October	...	6.18	16	4.68	20	4.86	12	4.76	19
November	...	7.39	20	4.32	15	5.45	18	8.20	23
December	...	2.89	12	2.97	13	7.35	22	4.00	14
January	...	2.00	12	0.84	7	3.79	21	0.58	6
February	...	2.98	9	0.53	5	1.64	13	0.96	14
March	...	1.92	6	0.99	8	1.43	15	1.18	10
April	...	1.08	6	0.30	2	0.43	7	1.66	7
Total	...	64.69	177	56.72	171	66.66	217	62.86	185

The yield of each plot for this and previous years is shown graphically for each set of experiments, so that the increase or decrease for the various plots from year to year can be seen at a glance.

In each set of experiments where the yield of individual trees has been kept, the results obtained have been calculated and tabulated in percentages of trees giving less than 13 pods per tree annually, from 13 to 25 pods per tree, etc., as shown in Tables II, VII, X, etc.

MANURIAL EXPERIMENTS.

A. FIELD No. 1.—The manures and mulch were applied to all plots during the first fortnight of March 1913, but the sheep manure to plots B, C and D was only applied on June 24. The results for the year under review are given in Table I and the average number of pods picked per tree for previous years is also included for comparison. There are 50 trees, more or less, in each plot.

The cacao reaped from all the plots in Field No. 1 and from the plots on the Brooklyn estate, during the year, have been dried and weighed separately. The results for this and previous years are recorded below.

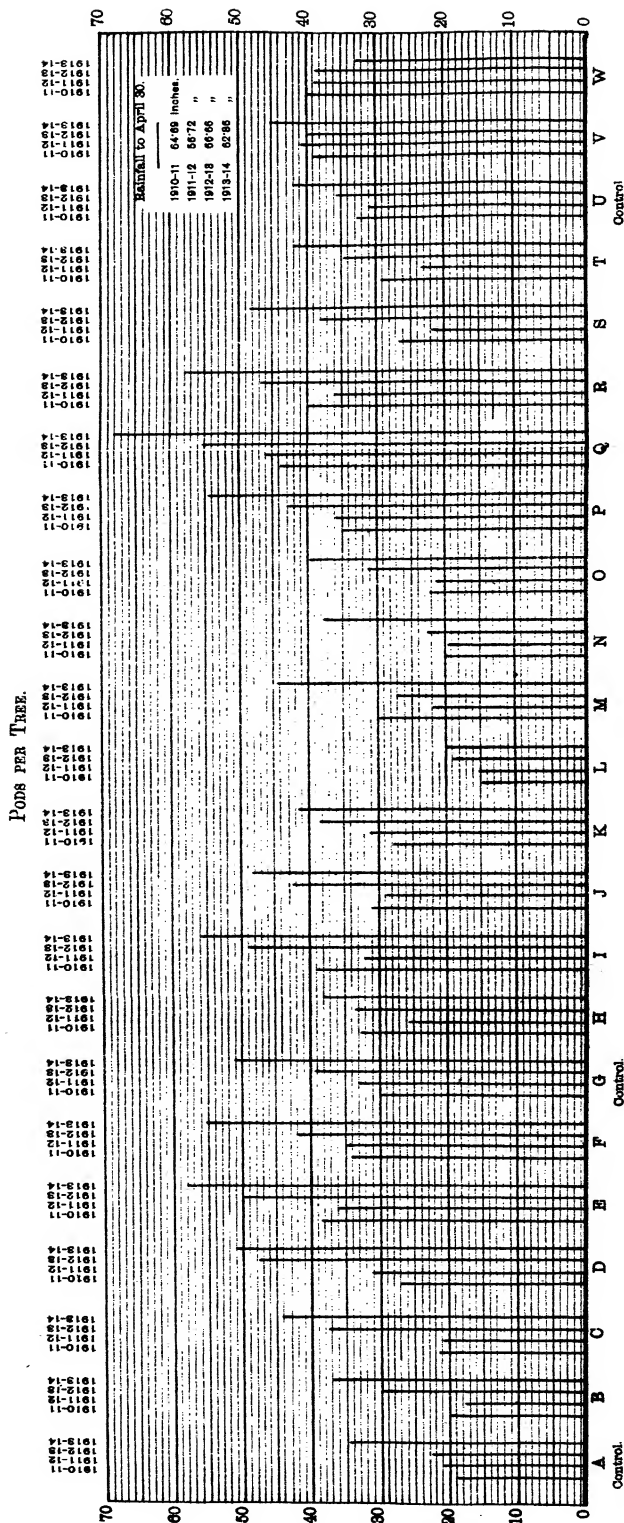
PARTICULARS.	RIVER ESTATE.			BROOKLYN ESTATE.		
	1911-12	1912-13	1913-14	1911-12	1912-13	1913-14
Total number of pods picked	35,596	46,137	56,294	68,261	80,098	92,141
Lb. dry cacao ...	2,779	3,839	4,710	5,520	7,363	8,185
Pods, per lb. dry cacao	12·81	12·02	11·95	12·37	10·88	11·26

The average for the three years is 12·18 and 11·41 pods per pound of dry cacao for River and Brooklyn estates respectively.

During the period under review there has been a further increase in yield from all the plots in Field No. 1, with the exception of W—limed plot. 871 pounds more of dry cacao have been reaped from all of the plots than during the previous twelve months and 1,496 pounds more than in 1910-11, calculated on a basis of 12 pods to a pound of dry cacao.

Plots D, F, M, N and Q have given a larger increase than any of the control plots, i.e. an increase of over 12 pods or one pound of dry cacao per tree. The increase from plots P, R and S of over 10 pods per tree is greater than that from the average of the three control plots. Compared with 1910-11 plots C, D, F, Q and S have given a larger increase than any of the control plots and B, E, I, J, N, O, P, and R show a larger increase than the average from the control plots.

Diagram 1.—Comparative yield of plots for four years from Field 1 at River Estate.



EXPLANATION.—The plots are indicated by the letters A, B, C, D, etc. A, G and U, are the control or no manure plots.

Each distance from 0 to 10, 20, etc., represents ten (10) pods per tree and therefore the distance from any one horizontal line to the next is equivalent to one (1) pod per tree. The average number of pods plotted per tree from each plot for each of the four years, has been plotted to scale and is therefore shown by the length of the vertical black lines.

TABLE I.- MANURIAL EXPERIMENTS—FIELD No. 1.

Trees about 11 years old in 1910.

Plot.	Manures applied per plot each year from 1910.	Average Number of Pods picked per tree.			YIELD—SEP. 1, 1913 TO AUG. 31, 1914.					
		1910-11.	1911-12.	1912-13.	Average No. of pods picked per tree.	Per acre of 300 trees.				
						No. of pods picked.	Lb. dry cacao.	Value of dry cacao at 11 cents per lb.	Cost of manur- ing.	Col. A less Col. B.
								(A) \$ c.	(B) \$ c.	\$ c.
A.	Control—No manure	18.3	20.51	22.00	34.27	10,281	857	94.27	...	94.27
B.	{ 280 lb. Sheep manure 100 „ Bone meal 25 „ Sulphate of potash }	19.4	17.02	29.78	36.06	10,818	901	99.11	23.31	75.80
C.	{ 280 lb. Sheep manure 13 „ Sulph. of ammonia 13 „ Sulphate of potash }	21.0	20.31	36.88	43.52	13,056	1,088	119.68	13.44	106.24
D.	560 lb. Sheep manure	26.6	30.27	47.15	50.21	15,063	1,255	138.05	17.25	120.80
E.	7,200 lb. Pen manure	38.0	35.60	49.40	57.61	17,283	1,440	158.40	24.81	133.59
F.	{ 3,600 lb. Pen manure 100 „ Basic slag 13 „ Sulphate of potash }	33.9	34.24	41.28	54.78	16,434	1,369	150.59	20.08	130.51
G.	Control—No manure	29.8	32.56	39.04	50.28	15,084	1,257	138.27	...	138.27
H.	187 lb. Bird manure	32.1	25.29	33.02	37.74	11,322	943	103.73	11.13	92.60
I.	{ 94 lb. Bird manure 25 „ Sulph. of ammonia 50 „ Sulphate of potash }	38.4	31.58	48.19	55.33	16,599	1,383	152.13	19.33	132.80
J.	{ 94 lb. Bird manure 13 „ Sulph. of ammonia 25 „ Sulphate of potash }	30.9	28.30	42.00	48.02	14,406	1,200	132.00	12.69	119.31
K.	{ 94 lb. Bird manure 100 „ Basic slag 25 „ Sulphate of potash }	27.8	30.59	37.90	41.21	12,363	1,030	113.30	15.52	97.78
L.	187 lb. Lime	14.1	14.67	18.69	19.90	5,970	497	54.67	4.73	49.94

*Dividing the figures in these columns by 2 gives approximately the number of bags (165 lb.) dry cacao per 1,000 trees.

TABLE 1.—*Contd.*—MANURIAL EXPERIMENTS—FIELD No. 1.

Plot.	Manures applied per plot <i>each year from 1910.</i>	Average Number of Pods picked per tree.			YIELD—SEP. 1, 1913, TO AUG. 31, 1914.					
		1910-11.	1911-12.	1912-13.	Average No. of pods picked per tree.	Per acre of 300 trees.				
						No. of pods picked.	Lb. dry cacao.	Value of dry cacao at 11 cents per lb.	Cost of manur- ing.	Col. A less Col. B.
		*	*	*	*			(A) \$ c.	(B) \$ c.	\$ c.
M	{ 5,000 lb. Mulch 100 „ Basic slag 25 „ Sulph. of potash }	29.4	21.74	26.40	44.04	13,212	1,101	121.11	36.46	84.65
N	{ 5,000 lb. Mulch 50 „ Basic slag 13 „ Sulph. ammonia 13 „ Sulph. of potash }	19.5	19.00	22.31	37.17	11,151	929	102.19	31.84	70.35
O	10,000 lb. Mulch	22.0	21.00	30.94	39.06	11,718	976	107.36	55.96	51.40
P	{ 3,600 lb. Pen Manure 100 „ Bone meal 13 „ Sulph. ammonia 13 „ Sulph. of potash }	34.8	35.40	42.83	54.02	16,206	1,350	148.50	27.40	121.10
Q	{ 3,600 lb. Pen manure 13 „ Sulph. ammonia 25 „ Sulph. of potash }	43.4	45.61	55.00	67.65	20,295	1,691	186.01	19.21	166.80
R	{ 25 lb. Sulph. ammonia 25 „ Sulph. of potash }	39.5	35.55	46.26	57.51	17,253	1,438	158.18	9.69	148.49
S	{ 200 lb. Bone meal 25 „ Sulph. ammonia 25 „ Sulph. of potash }	26.2	21.12	37.73	47.79	14,337	1,195	131.45	30.63	100.82
T	{ 100 lb. Basic slag 25 „ Sulph. ammonia 25 „ Sulph. of potash }	28.9	23.07	34.08	41.21	12,363	1,030	113.30	15.63	97.67
U	Control—No manure	32.1	30.92	35.67	41.51	12,453	1,038	114.18	...	114.18
V	187 lb. Bird manure	38.8	40.53	39.60	44.63	13,389	1,116	122.76	11.13	111.63
W	94 lb. Lime	39.1	38.16	38.27	32.45	9,735	811	86.21	2.36	86.85

*Dividing the figures in these columns by 2 gives approximately the number of bags (165 lb.) dry cacao per 1,000.

TABLE II.—YIELD OF INDIVIDUAL TREES IN FIELD NO. 1.

Trees about 11 years old in 1910.

Plot.	Number of trees.	Crop, Sept. 1, to August 31.	PER CENT. TREES BEARING THE FOLLOWING NUMBER OF PODS EACH YEAR.						Average number of pods picked per tree.
			0 12.	13 25.	26 50.	51 75.	76 100.	Over 100.	
A. Control	49	1911-12	49.0	20.4	20.4	6.1	4.1	...	20.51
	45	1912-13	42.2	24.4	26.7	4.5	...	2.2	22.00
	44	1913-14	22.7	25.0	36.4	2.3	9.1	4.5	34.27
B.	51	1911-12	49.0	21.6	27.4	2.0	...	...	17.02
	51	1912-13	25.5	21.6	37.2	9.8	5.9	...	29.78
	51	1913-14	21.6	19.6	29.4	23.5	2.0	3.9	36.06
C.	49	1911-12	38.8	26.5	28.6	6.1	...	...	20.31
	49	1912-13	14.3	12.3	46.9	20.4	4.1	2.0	36.88
	48	1913-14	6.3	18.7	41.7	20.8	8.3	4.2	43.52
D.	52	1911-12	13.4	30.8	40.4	15.4	...	...	30.27
	52	1912-13	9.6	9.6	38.5	30.8	7.7	3.8	47.15
	52	1913-14	5.8	11.5	42.3	26.9	7.7	5.8	50.21
E.	50	1911-12	14.0	20.0	38.0	22.0	6.0	...	35.60
	50	1912-13	8.0	14.0	35.0	22.0	14.0	6.0	49.40
	49	1913-14	6.1	14.3	30.6	16.4	16.3	16.3	57.61
F.	49	1911-12	32.7	20.4	20.4	12.2	10.2	4.1	34.24
	49	1912-13	28.6	12.2	22.5	24.5	6.1	6.1	41.28
	45	1913-14	17.8	11.1	31.1	8.9	11.1	20.0	54.78
G. Control	50	1911-12	20.0	28.0	34.0	12.0	4.0	2.0	32.56
	50	1912-13	20.0	16.0	24.0	34.0	2.0	4.0	39.04
	49	1913-14	10.2	14.3	30.6	24.5	10.2	10.2	50.28
H.	48	1911-12	29.1	31.3	20.8	18.8	...	...	25.29
	47	1912-13	29.8	14.9	40.4	6.4	4.3	4.2	33.02
	46	1913-14	21.7	17.4	41.3	8.7	4.4	6.5	37.74
I.	48	1911-12	22.9	31.3	25.0	14.6	6.2	...	31.58
	48	1912-13	18.8	12.5	33.3	18.7	4.2	12.5	48.19
	48	1913-14	10.4	8.4	37.5	20.8	8.3	14.6	55.33
J.	50	1911-12	32.0	20.0	32.0	12.0	...	4.0	28.30
	49	1912-13	22.4	14.3	28.6	20.4	6.1	8.2	42.00
	48	1913-14	16.7	14.6	29.1	18.8	14.6	6.2	48.02
K.	51	1911-12	25.5	21.6	33.3	13.7	3.9	2.0	30.59
	51	1912-13	15.7	25.5	31.4	17.6	5.9	3.9	37.90
	51	1913-14	19.6	17.6	27.5	21.6	9.8	3.9	41.21
L.	49	1911-12	57.1	18.4	20.5	2.0	2.0	...	14.67
	49	1912-13	42.8	28.6	18.4	10.2	...	...	18.69
	49	1913-14	38.8	24.5	28.6	8.1	...	...	19.90

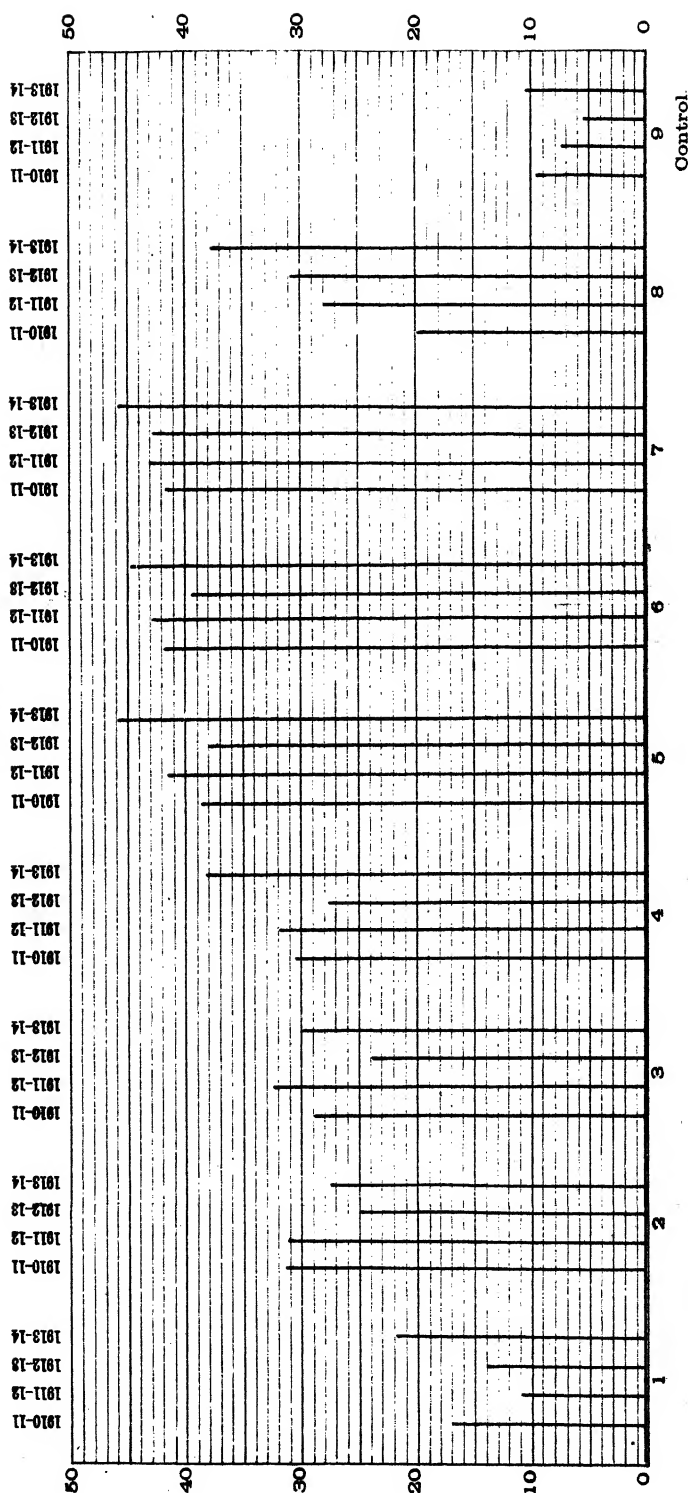
TABLE II. (Contd.).—YIELD OF INDIVIDUAL TREES IN FIELD No. 1.

Trees about 11 years old in 1910.

Plot.	Number of trees.	Crop, Sept. 1, to August 31.	PER CENT. TREES BEARING THE FOLLOWING NUMBER OF PODS IN EACH YEAR.						Average number of pods picked per tree.
			0-12	13-25	26-50	51-75	76-100	over 100	
M.	50	1911-12	38.0	30.0	22.0	8.0	2.0	...	21.74
	50	1912-13	24.0	26.0	46.0	4.0	...	...	26.40
	49	1913-14	16.3	12.3	30.6	26.5	10.2	4.1	44.04
N.	49	1911-12	44.9	26.5	22.5	4.1	2.0	...	19.00
	49	1912-13	42.9	20.4	26.5	6.1	4.1	...	22.31
	48	1913-14	29.1	12.5	31.3	12.5	10.4	4.2	37.17
O.	51	1911-12	29.4	43.2	19.6	7.8	...	...	21.00
	50	1912-13	14.0	26.0	46.0	10.0	4.0	...	30.94
	50	1913-14	12.0	26.0	34.0	14.0	12.0	2.0	39.06
P.	52	1911-12	21.2	28.8	25.0	9.6	9.6	5.8	35.40
	52	1912-13	13.5	21.1	30.8	23.1	3.8	7.7	42.83
	52	1913-14	5.8	13.5	36.5	23.1	9.6	11.5	54.02
Q.	49	1911-12	12.3	20.4	30.6	20.4	14.3	2.0	45.61
	48	1912-13	6.3	6.2	37.5	29.2	4.2	16.6	55.00
	46	1913-14	4.3	4.3	26.1	26.1	19.6	19.6	67.65
R.	51	1911-12	27.5	29.4	17.6	11.8	5.9	7.8	35.55
	50	1912-13	26.0	16.0	24.0	16.0	4.0	14.0	46.26
	49	1913-14	20.4	10.2	28.6	18.4	6.1	16.3	57.61
S.	49	1911-12	44.9	26.5	14.3	12.2	2.1	...	21.12
	49	1912-13	30.6	14.3	16.3	28.6	6.1	4.1	37.73
	47	1913-14	21.3	23.4	19.1	14.9	6.4	14.9	47.79
T.	52	1911-12	36.5	23.1	30.8	7.7	1.9	...	23.08
	52	1912-13	26.9	15.4	30.8	21.2	3.8	1.9	34.08
	52	1913-14	17.3	17.3	36.5	13.5	11.5	3.9	41.21
U. Control	51	1911-12	29.4	21.6	25.5	17.6	3.9	2.0	30.92
	51	1912-13	21.6	27.5	19.6	23.5	3.9	3.9	35.67
	51	1913-14	13.7	11.8	45.1	17.7	7.8	3.9	41.51
V.	52	1911-12	7.7	19.2	36.5	30.8	5.8	...	40.33
	52	1912-13	11.5	21.2	42.3	9.6	15.4	...	39.60
	52	1913-14	9.6	19.2	30.8	34.6	1.9	3.9	44.63
W.	51	1911-12	17.7	23.5	31.4	15.7	7.8	3.9	38.16
	51	1912-13	23.5	21.6	27.5	9.8	13.7	3.9	38.27
	51	1913-14	25.5	27.4	25.5	13.7	5.9	2.0	32.45
Average for 3 years for the Whole Field.			23.0	20.0	30.4	15.9	6.0	4.7	

Diagram II.—Comparative yield of plots for four years from Field No. 6 at River Estate.

PODS PER TREE.



EXPLANATION.—The plots are indicated by the numbers 1, 2, 3, 4, etc. 9 is the control or so manure plot.

Each distance from 0 to 10, 10 to 20 represents ten (10) pods per tree and therefore the distance from any one horizontal line to the next is equivalent to one (1) pod per tree.

The average number of pods picked per tree from each plot, for each of the four years, has been plotted to scale and is therefore shown by the length of the vertical black lines.

B.—FIELD No. 6.—The treatment accorded to each plot and the results obtained for this and previous years are recorded in Table III. Plot 4 was mulched in March, plots 1 and 3 were manured at the end of June and all the other plots in April, 1913. No forking was done except on plot 7 (pen manure).

All of the plots have this year given an increase on the previous year, but the increase from plots 1, 3, 4, 5, 6 and 8 is greater than the increase from the control plot. Compared with 1910-11, all the plots, except plot 2, have given a larger increase than the control plot.

The yield for the whole field this year is 12.82 bags per 1,000 trees compared with 9.77 bags last year and 5.64 bags for the year preceeding the application of manures.

TABLE III.—MANURIAL EXPERIMENTS.—FIELD No. 6.

Trees 25 to 30 years old in 1910.

Plot.	Number of bearing trees.	Manures applied per plot each year from 1910.	Average No. of pods picked per tree.			YIELD SEP. 1, 1913, TO AUG. 31, 1914.					
			1910-11.	1911-12.	1912-13.	Average No. of pods picked per tree.	Per acre of 220 trees.				
							No. of pods picked.	Lb. dry cacao.	Value of dry cacao at 11 cents per lb.	Cost of manuring.	Column A less Column B.
									(A)	(B)	
									\$ c.	\$ c.	\$ c.
1.	1,016	4 tons Sheep manure	16.8	10.70	13.84	21.71	4,776	398	43.78	9.89	33.89
2.	509	1 ton Bird manure	31.1	30.99	24.82	27.28	6,002	500	55.00	9.19	45.81
3.	506	{ 1 ton Sheep manure 1 „ Bird manure }	28.8	32.11	23.77	29.95	6,589	549	60.39	13.61	46.78
4.	186	18 tons Mulch	30.1	31.85	27.44	37.99	8,358	696	76.56	23.49	53.07
5.	279	{ 150 lb. Sulph. of ammonia 150 „ Sulph. of potash 1,200 „ Bone meal }	38.3	41.09	37.95	45.45	9,999	833	91.63	19.22	72.41
6.	274	{ 300 lb. Sulph. potash 1,200 „ Basic slag }	41.4	42.33	39.15	44.50	9,790	816	89.76	14.72	75.04
7.	1,073	80 tons Pen manure	41.3	42.68	42.29	45.37	9,981	832	91.52	37.78	53.74
8.	461	{ 125 lb. Sulph. of ammonia 250 „ Sulph. of potash 2,000 „ Basic slag }	19.9	28.00	30.54	37.50	8,250	687	75.57	13.13	62.44
9.	442	Control—No manure	9.8	7.40	5.54	10.36	2,279	190	20.50	...	20.90

* *Vide* Table I (foot note.)

C. FIELD No. 9. The experiments in this field are known as the "Ohlendorff's" plots. The manures were applied, as stated below, on March 17, 1913 and the results for this and preceding years are given in Table IV. No forking has been done on these plots.

TABLE IV.—MANURIAL EXPERIMENTS—FIELD No. 9.

Trees 9 to 10 years old in 1911.

Plot.	Number of bearing trees.	Manures applied per tree each year from 1911.	Average number of pods picked per tree.		YIELD—SEP. 1, 1913 TO AUG. 31, 1914.					
			1911-12.	1912-13.	Average number of pods picked per tree.	Per acre of 300 trees.				
						Number of pods picked.	Lb. dry cacao.	Value of dry cacao at 11 cents per lb.	Cost of manuring.	Col. A. less Col. B.
								(A)	(B)	
1	376	3 lb. Ohlendorff's cacao manure	*	*	*			\$ c.	\$ c.	\$ c.
			19.59	35.02	31.53	9,459	788	86.68	21.13	65.55
2	387	Control—No manure	11.87	16.78	20.36	6,108	509	55.99	...	55.99
3	393	2 lb. Ohlendorff's cacao manure	16.43	31.97	30.84	9,252	771	84.81	14.28	70.53

Although both of the manured plots show a decrease in 1913-14 against an increase from the control plot, compared with the previous year, it will be observed that the increase from the manured plots is greater than that from the control plot when compared with the first year's crop, *i.e.* for 1911-12.

D. FIELD No. 7. In 1913, three of the plots in this field on which the natural yield has been recorded for the two previous years, were manured as stated below, plot 10 being kept as a control. The trees are planted 12 feet apart and are situated on a sandy loam at the foot of hilly land. The basic slag and lime were applied in March 1913 and the other manures two months later, but no forking was done. The results obtained are recorded in Table V.

The heading "probable increase or decrease due to manuring" may require some explanation. The probable increase or decrease due to manuring is the difference between the yield of each plot respectively for the year (1913-14) and that of the *natural yield*, of the same plot previous to manuring, to which is added or deducted the decrease or increase shown by the control plot for the same periods. When a manured plot shows a larger increase on its *natural yield* than a control plot it may be assumed that the difference is due to the manures used. Although it is quite evident that all the plots do not show uniform increases or decreases each year (*vide* Natural yield of plots for Fields 2, 3, 4, 5 and 7 p.p. 90-92)

* *Vide* Table I (foot note.)

nevertheless, if the average be taken over a series of years the variation will be greatly reduced.

"Value of decrease due to manuring" means that the cost of the manures and of their application is greater than the value of the increased yield obtained.

TABLE V—MANURIAL EXPERIMENTS.—FIELD No. 7.

Trees 10 to 12 years old in 1911.

Plot.	Number of bearing trees.	Manures applied per acre each year from 1913.	AVERAGE NUMBER OF PODS PICKED PER TREE SEPT. 1, TO AUG. 31.				Per acre of 330 trees.		
			Natural yield—2 yrs. 1911-12, 1912-13.	Yield 1913-14 (after manur- ing).	Increase or decrease on natural yield. Probable in- crease or de- crease due to manuring.	Value of probable increase or decrease due to manuring at 11 cents per lb. dry cacao.	Cost of manuring.	Gain or Loss on control or no manure plot.	
8	49	500 lb. Basic slag. 200 .. Sulphate of ammonia 80 .. Sulphate of potash	31.54	49.75	18.21	8.73	\$ 24.01	\$ 14.87	\$ 9.14
9	51	500 lb. Lime. 200 .. Sulphate of ammonia 80 .. Sulphate of potash.	36.31	45.57	9.25	0.22	- 0.60	12.08	-12.68
10	46	Control—No manure	41.24	50.72	9.48				

From these results it will be seen that plot 8 has given an increase of 18.21 pods per tree on its *natural yield*, or 8.73 pods more than the increase obtained from the control plot, and it is probable that this additional increase over the control plot, viz.—8.73 pods per tree, is due to the manures applied. When the cost of manuring is deducted from the value of the probable increase due to manuring, there remains a profit of \$9.14 on plot 8, but in the case of plot 9, there has been a smaller increase than that from the control plot and consequently a loss of \$12.68 is indicated.

SHADE EXPERIMENTS.

E.—SHADE EXPERIMENTS.—These are being made in fields 5 and 10, and the particulars are given under Tables VI and VIII. As the trees in the *Shade* and *Chupon* experiments are planted at different distances in fields 5 and 10 and in the D and DD series respectively, it is necessary in order to be able to compare the results, to record the yields per acre and not per tree.

* *Vide Table I* (foot note.)

TABLE VI.—SHADE EXPERIMENTS.—FIELD No. 5.

Trees 25 to 30 years old in 1910.

Plot.	Distance planted.	Treatment.	NUMBER OF PODS PICKED PER ACRE OF 190 TREES.			
			1910-11.	1911-12.	1912-13.	1913-14.
A.	15' x 15'	Full shade	9,105	8,666	9,083	9,839
B.*	15' x 15'	No shade	11,575	10,393	8,446	11,284
C.†	15' x 15'	Partial shade	10,179	10,453	9,012	11,794

* All the Bocare Immortel were cut out and all the Anauco trees barked in July and August, 1910.

† 50 per cent. of the Immortel trees were barked in August, 1910.

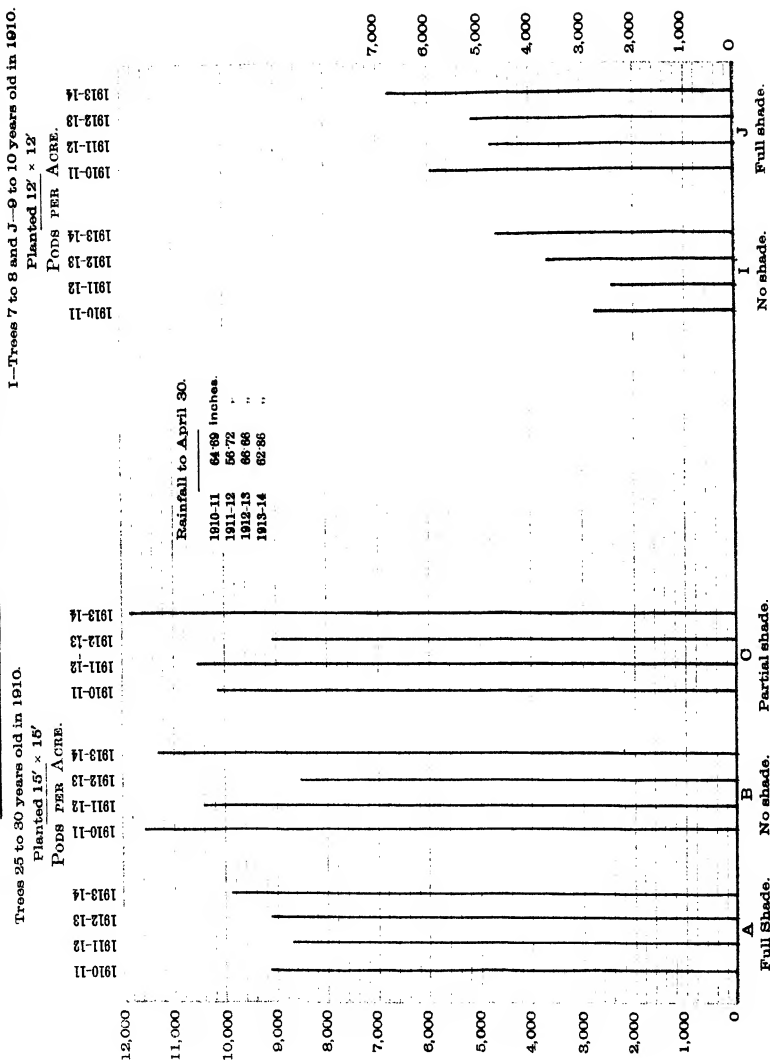
Plots A and C have given in 1913-14 an increase of 784 and 1,615 pods per acre respectively compared with crop 1910-11, whereas the *no shade* plot B shows a decrease of 291 pods per acre. The trees in plot B have now practically recovered from the damage sustained by the felling and barking of the immortal trees but they have been more susceptible to attacks of the cacao beetle (*Steirastoma depressum* L.) than those in the shaded plots.

TABLE VII.—YIELD OF INDIVIDUAL TREES IN SHADE EXPERIMENTS.—FIELD No. 5.

Plot.	Number of trees.	Crop, Sep. 1, to August 31.	PER CENT. TREES BEARING THE FOLLOWING NUMBER OF PODS IN EACH YEAR.						Average number of pods picked per tree.
			0-12.	13-25.	26-50.	51-75.	76-100.	Over 100.	
A. Full Shade	500	1910-11	22.4	19.6	29.0	14.8	5.2	9.0	47.92
	498	1911-12	18.5	19.5	28.1	18.3	5.4	10.2	45.61
	492	1912-13	23.0	15.5	25.8	14.2	7.7	13.8	47.81
	490	1913-14	18.1	14.7	33.3	17.7	8.4	12.8	51.78
Average for 4 years			19.3	17.4	29.0	16.2	6.7	11.4	
B. No Shade	500	1910-11	17.0	16.4	25.6	18.0	8.4	14.6	60.92
	500	1911-12	15.2	18.0	27.0	17.0	9.6	13.2	54.70
	493	1912-13	21.9	16.2	27.4	16.1	10.1	8.3	44.45
	485	1913-14	15.7	14.0	24.3	16.5	13.2	16.3	59.39
Average for 4 years			17.5	16.1	26.1	16.9	10.3	13.1	
C. Partial Shade	500	1910-11	17.0	16.8	28.0	15.8	12.0	10.4	53.57
	498	1911-12	15.7	14.8	27.1	16.9	10.2	15.3	55.02
	497	1912-13	19.1	16.3	27.8	18.1	7.6	11.1	47.43
	496	1913-14	12.1	10.5	23.2	23.6	11.5	19.1	62.08
Average for 4 years			16.0	14.6	26.5	18.6	10.3	14.0	

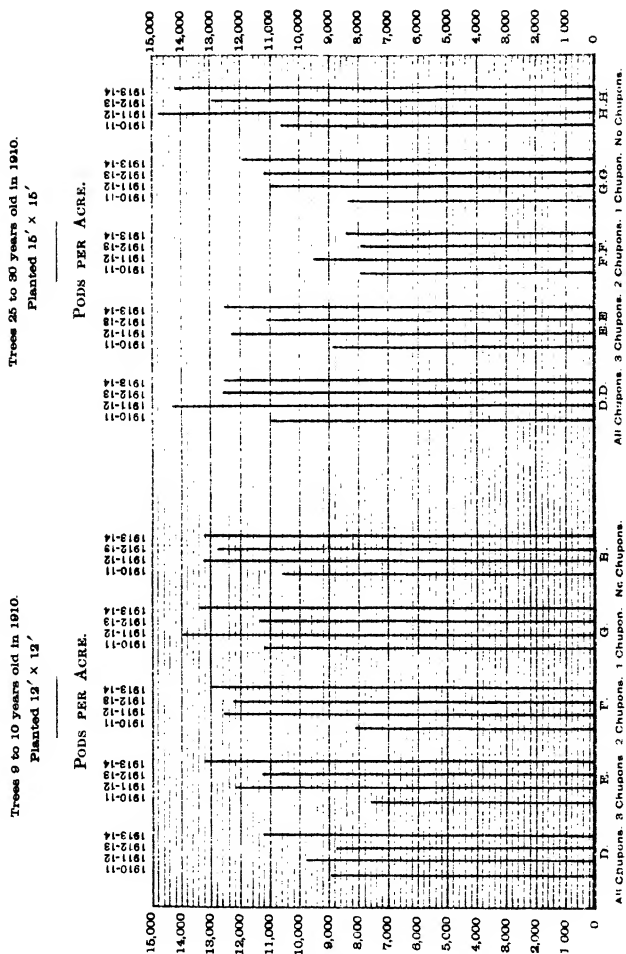
The shade and chupon experiments are made in order to ascertain what is desirable and what is undesirable in these methods of cultivation. The results obtained up to the present time are published, but the Department is not yet in a position to express a definite opinion on these methods which have given rise to much discussion during a great number of years.—P.C.

Diagram III.—Comparative yield of plots for four years in Shade Experiments.



EXPLANATION.—Each distance from 0 to 1,000, 1,000 to 2,000, etc., represents one thousand (1,000) pods per acre and therefore the distance from any one horizontal line to the next is equivalent to two hundred (200) pods per acre.
The number of pods picked per acre from each plot for each of the four years, has been plotted to scale and is therefore shown by the length of the vertical black lines.

Diagram IV.—Comparative yield of plots for four years in Chupon Experiments.



EXPLANATION.—Each distance from 0 to 1,000, 1,000 to 2,000, etc., represents one thousand (1,000) pods per acre. The distance from any one horizontal line to the next is equivalent to two hundred (200) pods per acre.

The number of pods picked per acre from each plot, for each of the four years, has been plotted to scale and is therefore shown by the length of the vertical black lines.

TABLE X.—YIELD OF INDIVIDUAL TREES IN CHUPON EXPERIMENTS—
FIELD No. 8.*Trees planted 12' x 12' Age 9 to 10 years in 1910.*

Plot.	Number of trees.	Crop, Sept. 1, to August 31.	PER CENT. TREES BEARING THE FOLLOWING NUMBER OF PODS IN EACH YEAR.						Average number of pods picked per tree.
			0-12	13-25	26-50	51-75	76-100	over 100	
D. All Chupons	100	1910-11	25.0	27.0	33.0	11.0	3.0	1.0	29.64
	100	1911-12	21.0	19.0	38.0	19.0	1.0	2.0	32.34
	100	1912-13	30.0	23.0	30.0	13.0	3.0	1.0	28.80
	100	1913-14	17.0	25.0	29.0	22.0	3.0	4.0	37.28
Average for 4 years			23.3	23.5	32.5	16.2	2.5	2.0	
E. Three Chupons	100	1910-11	23.0	40.0	26.0	8.0	3.0		25.04
	100	1911-12	16.0	21.0	34.0	17.0	7.0	5.0	40.44
	99	1912-13	18.2	23.2	30.3	18.2	7.1	3.0	37.32
	98	1913-14	11.2	17.3	42.9	17.4	4.1	7.1	43.43
Average for 4 years			17.1	25.4	33.3	15.1	5.3	3.8	
F. Two Chupons	100	1910-11	26.0	30.0	33.0	9.0	2.0		26.75
	99	1911-12	18.2	16.2	36.4	14.1	10.1	5.0	41.30
	99	1912-13	16.1	28.3	26.3	16.2	5.0	8.1	40.69
	98	1913-14	12.3	20.4	32.6	20.4	8.2	6.1	43.23
Average for 4 years			18.1	23.7	32.1	15.0	6.3	4.8	
G. One Chupon	100	1910-11	14.0	24.0	39.0	15.0	2.0	6.0	36.87
	100	1911-12	18.0	12.0	34.0	19.0	9.0	8.0	46.14
	99	1912-13	27.3	23.2	24.2	11.1	7.1	7.1	37.73
	99	1913-14	22.2	16.2	24.2	18.2	10.1	9.1	41.51
Average for 4 years			20.4	18.9	30.4	15.8	7.0	7.5	
H. No Chupons	100	1910-11	20.0	15.0	40.0	19.0	4.0	2.0	34.87
	100	1911-12	14.0	17.0	29.0	29.0	5.0	6.0	41.05
	100	1912-13	16.0	22.0	34.0	15.0	5.0	8.0	42.51
	100	1913-14	18.0	10.0	32.0	27.0	9.0	4.0	43.93
Average for 4 years			17.0	16.0	33.8	22.5	5.7	5.0	

TABLE XI—CHUPON EXPERIMENTS.—FIELD No. 8.

Trees 25 to 30 years old in 1910.

Plot.	Distance Planted.	Treatment.	NUMBER OF PODS PICKED PER ACRE OF 190 TREES.			
			1910-11	1911-12	1912-13	1913-14
D.D.	15' x 15'	All chupons allowed to grow	10,898	14,248	12,486	12,548
E.E.	15' x 15'	3 " " "	8,860	12,274	11,108	12,525
F.F.	15' x 15'	2 " " "	7,921	9,448	7,838	8,360
G.G.	15' x 15'	1 chupon " "	8,290	10,876	11,148	11,956
H.H.	15' x 15'	No chupons " "	10,613	14,670	12,899	14,157

The object of these experiments as stated in previous reports is to see to what extent the yield will be affected by allowing all, or some, or no chupons to grow.

TABLE XII.—YIELD OF INDIVIDUAL TREES IN CHUPON EXPERIMENTS.—
FIELD No. 8.*Trees planted 15' x 15'—Age 25 to 30 years in 1910.*

Plot.	Number of trees.	Crop, Sep. 1, to August 31.	PER CENT. TREES BEARING THE FOLLOWING NUMBER OF PODS IN EACH YEAR.						Average number of pods picked per tree.
			0-12.	13-25.	26-50.	51-75.	76-100.	Over 100.	
D.D. All Chupons	100	1910-11	11.0	15.0	28.0	19.0	10.0	17.0	57.36
	100	1911-12	8.0	7.0	25.0	20.0	18.0	22.0	74.99
	99	1912-13	8.1	11.1	24.2	23.2	16.2	17.2	65.72
	99	1913-14	7.0	8.1	28.3	27.3	12.1	17.2	66.04
Average for 4 years...			8.5	10.3	26.4	22.4	14.1	18.3	
E.E. Three Chupons	100	1910-11	18.0	16.0	31.0	19.0	7.0	9.0	46.63
	100	1911-12	15.0	12.0	21.0	18.0	11.0	23.0	64.60
	99	1912-13	14.2	14.1	26.3	20.2	11.1	14.1	58.16
	99	1913-14	5.1	15.1	27.3	13.1	21.2	18.2	65.92
Average for 4 years...			13.0	14.3	26.4	17.6	12.6	16.1	
F.F. Two Chupons	100	1910-11	20.0	18.0	29.0	16.0	13.0	4.0	41.69
	99	1911-12	14.1	20.2	25.3	19.2	1.1	11.1	49.73
	99	1912-13	26.3	20.2	25.2	12.1	6.1	10.1	41.25
	99	1913-14	18.2	19.2	27.3	18.2	10.1	7.0	44.45
Average for 4 years...			19.7	19.4	26.7	16.4	9.8	8.0	
G.G. One Chupon	100	1910-11	17.0	24.0	28.0	16.0	9.0	6.0	43.63
	98	1911-12	13.3	14.3	25.5	16.3	15.3	15.3	57.24
	95	1912-13	9.5	17.9	25.3	23.1	8.4	15.8	58.67
	94	1913-14	9.6	12.8	29.8	8.5	20.2	19.1	62.92
Average for 4 years...			12.4	17.3	27.1	16.0	13.2	14.0	
H.H. No Chupons	100	1910-11	13.0	15.0	23.0	28.0	8.0	13.0	55.86
	100	1911-12	9.0	5.0	28.0	16.0	16.0	26.0	77.21
	100	1912-13	17.0	5.0	25.0	22.0	8.0	23.0	67.89
	100	1913-14	9.0	8.0	24.0	23.0	15.0	21.0	74.51
Average for 4 years...			12.0	8.2	25.0	22.2	11.8	20.8	

TABLE XV.—NATURAL YIELD OF PLOTS.

AVERAGE NUMBER OF PODS PICKED PER TREE.

	Field No. 2.		Field No. 3.		Field No. 4.		Field No. 5.		Field No. 7.	
	1912-13.	1913-14.	1912-13.	1913-14.	1912-13.	1913-14.	1912-13.	1913-14.	Average for 2 yrs. 1911-13.	1913-14.
	*	*	*	*	*	*	*	*	*	*
Highest	26.58	40.82	26.40	43.97	39.92	55.16	34.25	42.56	28.30	35.00
Lowest	15.30	26.59	11.71	19.35	24.47	25.19	18.31	30.20	14.06	16.02
Difference	11.28	14.23	14.69	24.62	15.45	29.97	15.94	12.36	14.24	18.98

It is evident from these figures that it would be absolutely erroneous to consider any one plot as a control for any series of plots.

NATURAL YIELD OF INDIVIDUAL TREES.

All the trees in the *natural yield* plots in fields 2, 3, 4, 5 and 7—approximately 6,338 trees—have been labelled and the number of pods picked from each tree recorded. The returns are very interesting and the percentage of trees in each plot bearing less than 13 pods per tree annually, from 13 to 25 pods per tree, &c., from each field respectively, has been calculated. The results obtained are shown in Tables XVI to XX.

TABLE XVI.—NATURAL YIELD OF INDIVIDUAL TREES.—FIELD No. 2.

Trees 27 to 32 years old in 1912.

Plot.	Number of trees.	Crop, Sep. 1. to August 31.	PER CENT. TREES BEARING THE FOLLOWING NUMBER OF PODS EACH YEAR.						Average number of pods picked per tree.
			0-12.	13-25.	26-50.	51-75.	76-100.	Over 100.	
1 {	298	1912-13	48.7	18.8	18.4	6.0	4.4	3.7	24.98
	290	1913-14	34.1	15.9	24.8	9.7	6.2	9.3	37.27
2 {	382	1912-13	43.5	20.7	19.4	9.4	4.4	2.6	26.58
	374	1913-14	29.1	19.5	24.9	11.2	7.3	8.0	38.41
3 {	209	1912-13	42.6	20.1	22.9	7.2	4.8	2.4	26.05
	208	1913-14	27.4	21.6	27.9	12.0	5.3	5.8	35.28
4 {	398	1912-13	58.5	20.9	14.8	5.0	0.5	0.3	15.81
	396	1913-14	38.6	17.2	22.7	14.7	4.0	2.8	28.04
5 {	387	1912-13	42.1	23.3	19.1	8.8	4.4	2.3	25.99
	386	1913-14	21.3	20.2	31.6	12.4	6.7	7.8	40.82
6 {	384	1912-13	61.5	19.3	12.2	3.9	2.1	1.0	15.84
	378	1913-14	42.1	15.4	22.2	11.9	3.4	5.0	30.28
7 {	321	1912-13	64.5	16.5	11.8	5.3	1.6	0.3	15.30
	318	1913-14	44.3	17.6	19.8	9.8	4.7	3.8	26.59
8 {	338	1912-13	48.2	23.1	18.9	5.6	3.3	0.9	21.32
	338	1913-14	25.4	23.7	28.7	12.4	5.9	3.9	32.96
Average for 2 years for the whole Field			42.0	19.7	21.2	9.1	4.3	3.7	

* Vide Table I (foot note.)

TABLE XVII—NATURAL YIELD OF INDIVIDUAL TREES.—FIELD No. 3.

Trees 27 to 32 years old in 1912.

Plot.	Number of trees.	Crop, Sep. 1, to Aug. 31.	PER CENT. TREES BEARING THE FOLLOWING NUMBER OF PODS IN EACH YEAR.						Average No. of pods picked per tree.
			0-12	13-25	26-50	51-75	76-100	over 100	
1 {	208	1912-13	54.8	15.4	22.1	6.2	0.5	1.0	17.27
	204	1913-14	32.4	19.1	23.0	16.7	4.4	4.4	32.46
2 {	235	1912-13	40.4	22.1	24.3	8.1	0.4	4.7	26.40
	231	1913-14	28.1	13.8	26.0	16.9	6.1	9.1	43.97
3 {	220	1912-13	55.5	17.7	17.3	5.0	2.7	1.8	19.64
	216	1913-14	33.8	23.6	22.2	11.1	6.5	2.8	30.64
4 {	243	1912-13	43.6	23.9	20.2	9.0	2.5	0.8	21.97
	239	1913-14	33.9	17.6	25.1	15.0	6.7	3.7	32.87
5 {	221	1912-13	56.1	18.5	16.7	4.1	1.4	3.2	19.56
	217	1913-14	39.2	23.0	20.3	9.7	5.5	2.3	27.12
6 {	225	1912-13	71.5	13.8	10.7	1.8	1.8	0.4	11.71
	219	1913-14	55.7	15.1	19.2	5.5	2.7	1.8	19.35
7 {	208	1912-13	61.5	14.0	16.8	5.8	1.4	0.5	15.42
	203	1913-14	56.7	14.3	16.7	5.9	4.4	2.0	20.67
Average for 2 years for the whole Field			47.4	18.1	20.0	8.4	3.4	2.7	...

TABLE XVIII—NATURAL YIELD OF INDIVIDUAL TREES.—FIELD No. 4.

Trees 27 to 32 years old in 1912.

Plot.	Number of trees.	Crop, Sep. 1, to Aug. 31.	PER CENT. TREES BEARING THE FOLLOWING NUMBER OF PODS IN EACH YEAR.						Average No. of pods picked per tree.
			0-12	13-25	26-50	51-75	76-100	over 100	
1 {	186	1912-13	37.6	28.0	21.5	7.5	4.3	1.1	24.47
	184	1913-14	36.9	22.3	27.2	8.7	3.3	1.6	25.19
2 {	174	1912-13	25.9	21.8	23.5	16.1	7.5	5.2	37.78
	174	1913-14	26.4	13.2	29.3	10.4	6.9	13.8	46.20
3 {	184	1912-13	31.5	22.8	25.5	10.9	7.1	2.2	31.15
	183	1913-14	24.6	23.5	27.3	15.3	2.7	6.6	35.92
4 {	164	1912-13	30.5	23.8	20.7	10.4	7.9	6.7	37.90
	164	1913-14	32.3	18.3	25.0	12.2	4.9	7.3	37.92
5 {	176	1912-13	47.2	19.9	17.0	8.5	5.1	2.3	25.00
	176	1913-14	38.6	22.2	21.0	6.8	4.0	7.4	31.26
6 {	195	1912-13	34.3	23.6	23.1	7.7	4.6	6.7	33.03
	193	1913-14	23.8	21.2	24.3	13.0	7.3	10.4	43.93
7 {	186	1912-13	28.7	19.9	20.0	12.4	5.9	9.1	39.92
	184	1913-14	16.3	10.9	28.2	21.2	8.2	15.2	55.16
Average for 2 years for the whole Field			30.7	20.8	24.5	11.5	5.7	6.8	

TABLE XIX.—NATURAL YIELD OF INDIVIDUAL TREES.—FIELD No. 5.

Trees 27 to 33 years old in 1912.

Plot.	Number of trees.	Crop, Sep. 1, to Aug. 31.	PER CENT. TREES BEARING THE FOLLOWING NUMBER OF PODS IN EACH YEAR.						Average number of pods picked per tree.
			0-12.	13-25.	26-50.	51-75.	76-100.	Over 100.	
1	88	1912-13	40.9	13.7	26.1	9.1	1.1	9.1	34.25
	88	1913-14	31.8	18.2	22.7	10.2	8.0	9.1	42.56
2	80	1912-13	51.3	17.5	15.0	11.2	2.5	2.5	22.76
	80	1913-14	40.0	15.0	22.5	11.3	7.5	3.7	31.79
3	98	1912-13	48.0	19.4	22.4	6.1	4.1	...	20.83
	98	1913-14	29.6	21.4	27.6	12.2	5.1	4.1	34.20
4	82	1912-13	45.1	26.8	18.3	6.1	3.7	...	20.18
	81	1913-14	28.4	16.0	27.2	12.3	9.9	6.2	39.78
5	113	1912-13	55.7	20.3	14.2	6.2	1.8	1.8	18.31
	112	1913-14	44.6	15.2	23.2	5.4	4.5	7.1	30.20
Average for 2 years for the whole Field			41.5	18.4	21.9	9.0	4.8	4.4	

TABLE XX.—NATURAL YIELD OF INDIVIDUAL TREES.—FIELD No. 7.

Trees 11 to 13 years old in 1912.

Plot.	Number of trees.	Crop, Sep. 1, to Aug. 31.	PER CENT. TREES BEARING THE FOLLOWING NUMBER OF PODS IN EACH YEAR.						Average number of pods picked per tree.
			0-12.	13-25.	26-50.	51-75.	76-100.	Over 100.	
1	47	1912-13	51.1	25.5	19.1	4.3	...	...	16.98
	44	1913-14	52.3	29.5	13.6	4.6	...	...	16.02
2	46	1912-13	26.1	19.6	39.1	6.5	6.5	2.2	32.39
	46	1913-14	32.6	28.3	21.7	15.2	2.2	...	26.02
3	44	1912-13	29.5	20.5	27.3	20.4	...	2.3	31.79
	42	1913-14	31.0	28.6	23.8	7.1	7.1	2.4	29.33
4	50	1912-13	48.0	14.0	24.0	12.0	...	2.0	23.30
	50	1913-14	46.0	30.0	22.0	2.0	...	...	16.50
5	51	1912-13	37.2	25.5	21.6	9.8	5.9	...	26.76
	50	1913-14	26.0	30.0	30.0	8.0	...	6.0	31.30
6	51	1912-13	21.6	27.5	33.3	13.7	3.9	...	30.80
	50	1913-14	20.0	16.0	44.0	12.0	4.0	4.0	35.00
7	46	1912-13	26.1	8.7	41.3	15.2	6.5	2.2	34.61
	43	1913-14	27.9	25.6	27.9	11.6	7.0	...	30.77
Average for 2 years for the whole Field			33.9	23.5	27.8	10.2	3.1	1.5	

TABLE XXI.—COMPARATIVE RETURN OF PERCENTAGE OF TREES BEARING THE INDICATED NUMBER OF PODS IN EACH YEAR, BASED AS AVERAGES IN TABLES XVI TO XX.

Field.	Age of trees in 1912.	No of years of observation.	PERCENTAGE OF TREES BEARING THE FOLLOWING NUMBER OF PODS.					
			0-12.	13-25.	26-50.	51-75.	76-100.	Over 100.
No. 2	27-32	2	42.0	19.7	21.2	9.1	4.3	3.7
„ 3	27-32	2	47.4	18.1	20.0	8.4	3.4	2.7
„ 4	27-32	2	30.7	20.8	24.5	11.5	5.7	6.8
„ 5	27-32	2	41.5	18.4	21.9	9.0	4.8	4.4
„ 7	11-13	2	33.9	23.5	27.8	10.2	3.1	1.5

The figures recorded in Tables XVI to XX show :—

1. That a large proportion of the trees in these fields has given less than 13 pods or a pound of dry cacao per annum during the past two years.

2. That although a favourable season considerably reduces the percentage of trees bearing less than a pound of dry cacao per annum, the proportion of these during the two years for the above fields is not less than 30 per cent. on an average.

3. That the comparative yield of the plots in each field for each year is largely dependent on the relative proportion of high and low bearing trees thereon and that generally the percentage of trees bearing less than 13 pods per tree appears to exert the largest influence on the relative yield of the plots.

Generally, it has been observed that the heavy bearing trees of the first year have continued to be heavy bearers, and that the poor yielding trees have remained poor during the following year. The detection of poor bearing trees on an estate and their subsequent replacement with trees raised from stock, or budded or grafted trees, of known prolific and other qualities is deserving of serious consideration. The advisability of improving the crop of poor yielding fields on an estate, by replacing the trees which bear an average of less than 13 pods annually, appears to be clearly indicated and should form part of the experiments to be made later on the *natural yield* plots.

TABLE XXIV—MANURIAL EXPERIMENTS,—BROOKLYN ESTATE.

Trees 18 to 20 years old in 1911.

Plot.	Manures applied per tree each year from 1911.	Average No. of pods picked per tree.		YIELD—SEP. 1, 1913 TO AUG. 31, 1914.						
		1911-12.	1912-13.	Average Number of pods picked per tree.	Per acre of 258 trees.					
					Number of pods picked.	Lb. Dry Cacao.	Value of dry cacao at 11c. per lb.	Cost of manuring.	Col. A less Col. B.	
							(A)	(B)		
		*	*	*			\$ c.	\$ c.	\$ c.	
1A	120 lb. Pen manure ...	23.66	22.82	27.04	6,976	581	63.91	19.39	44.52	
1B	{ 5 lb. Sheep manure 4 ,, Basic slag ½ ,, Sulph. of potash }	31.75	38.75	40.10	10,346	862	94.82	20.38	74.44	
2	Control—No manure	21.21	22.86	27.02	6,971	581	63.91	...	63.91	
3	{ 5 lb. Sheep manure 2 ,, Superph. of lime }	24.68	27.23	29.96	7,730	644	70.84	14.35	56.49	
4	Control—No manure	16.45	17.30	21.53	5,555	463	50.93	...	50.93	
5	3 lb. Lime ...	16.53	19.10	21.39	5,519	460	50.60	3.80	46.80	
6	{ 5 lb. Sheep manure 2 ,, Superph. of lime ½ ,, Sulph. of potash }	18.40	24.29	24.62	6,352	529	58.19	17.80	40.39	
7†	{ 4 lb. Basic slag 1 ,, Sulphate of potash }	27.96	32.67	33.50	8,643	720	79.20	17.50	61.70	
8	Control—No manure	16.63	22.68	26.53	6,845	570	62.70	..	62.70	
9§	{ 3 lb. Lime 1 ,, Superph. of lime }	16.50	21.95	27.83	7,180	598	65.78	7.54	58.24	
10	Control—No manure	16.11	19.24	21.68	5,593	466	51.26	...	51.26	
11	{ 2 lb. Bone meal ½ ,, Sulph. of ammonia ½ ,, Sulph. of potash }	22.73	24.85	34.01	8,774	731	80.41	17.48	62.93	

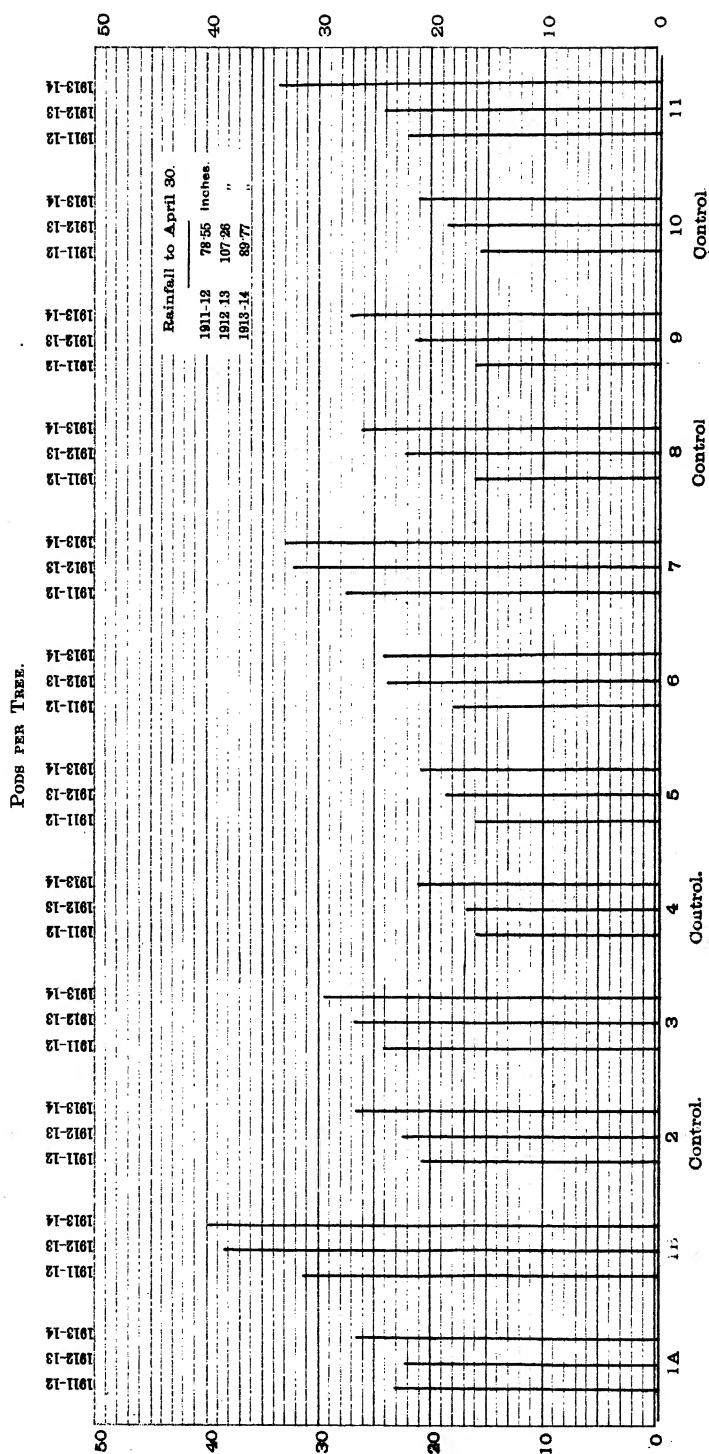
All the plots have given an appreciable increase and 2,665 lb. more of dry cacao have been reaped than for the crop of 1911-12. Plots 1B, 9 and 11, have given a larger increase than the control plots, but the average increase from all of the manured plots is 1,814 pods per acre, against 1,700 pods from the control plots.

* *Vide* Table I (foot note).

† Applied in two equal dressings at an interval of 3 months.

§ Superphosphate applied three months after the lime.

Diagram V.—Comparative yield of plots for three years on Brooklyn Estate.



EXPLANATION.—The plots are indicated by the numbers 1A, 1B, 2, 3, 4, etc. 2, 4, 8 and 10 are the control or no manure plots.

Each distance from 0 to 10, 10 to 20 represents ten (10) pods per tree and therefore the distance from any one horizontal line to the next is equivalent to one (1) pod per tree. The average number of pods picked from each plot, for each of the three years, has been plotted to scale and is therefore shown by the length of the vertical black lines.

Tobago Estates.

CACAO AND RUBBER EXPERIMENTS.

RICHMOND ESTATE.—(Mixed Cacao and Castilloa Rubber).

The plots received the same treatment as in previous years. The artificial manures were applied on April 7th, 1913, the pen manure to plot 5 in June and the mulch to plot 4 in July. All the plots, including the control plot, were forked.

The yield from the cacao trees for this and previous years is recorded in Table XXVI.

The rubber trees were measured on March 16, 1913, and the average girth of the trees for each plot is recorded in Table XXV, but the trees were not tapped during the year owing to the low price of rubber.

TABLE XXV.—CACAO AND RUBBER EXPERIMENTS.—RICHMOND ESTATE.

Trees 12 years old in 1911.

Plot.	Description of trees.	Number of bearing trees.	Per Plot.		AVERAGE GIRTH OF RUBBER TREES 3 FT. ABOVE THE GROUND.			
			Manures applied each year from 1911.	Cost of manuring.	Measured Oct., 1911.	Measured Mar., 1912.	Measured June, 1913.	Measured Mar., 1914.
				\$ c.	Ins.	Ins.	Ins.	Ins.
1	Cacao ...	92	188 lb. Bone meal	6.89	...	...	...	...
	Rubber ...	13	94 „ Sulph. of ammonia	0.97	39.9	42.1	44.1	45.3
			47 „ Sulph. of potash					
2	Cacao ...	88	180 lb. Basic slag	2.57	...	...	...	...
	Rubber ...	13	45 „ Sulph. of potash	0.38	42.9	45.0	46.9	48.2
3	Cacao ...	81	Control—No manure	...	42.6	44.0	45.3	46.5
	Rubber ...	9						
4	Cacao ...	78	8,300 lb. Mulch	10.65	...	...	...	...
	Rubber ...	11	83 „ Sulph. of ammonia	1.50	41.9	43.9	45.0	46.0
			45 „ Sulph. of potash					
5	Cacao ...	76	6,600 lb. Pen manure	4.79	...	...	...	...
	Rubber ...	13		0.82	36.1	39.3	41.5	43.2

TABLE XXVI—YIELD OF CACAO FROM RICHMOND ESTATE PLOTS.

Plot.	Average Number of pods picked per tree.		YIELD : SEPTEMBER 1, 1913 TO AUGUST 31, 1914.					
	1911-12.	1912-13.	Average number of pods picked per tree.	Per acre of 300 trees.				
				Number of pods picked.	Lb. dry cacao.	Value of dry cacao at 11c. per lb.	Cost of manuring.	Col. (A) less Col. (B.)
	*	*	*			(A)	(B)	
1	35.35	32.52	29.76	8,928	744	\$ c. 81.84	\$ c. 22.47	\$ c. 59.37
2	28.66	27.72	26.40	7,920	660	72.60	8.77	63.83
3	26.08	21.30	20.72	6,216	518	56.98	..	56.98
4	28.91	25.78	28.36	8,508	709	77.99	40.95	37.04
5	36.50	30.66	31.43	9,429	786	86.46	18.91	67.55

All the plots show a decrease in yield compared with the crop of 1911-12, but the decrease from the control plot is 1,603 pods per acre against 1,010 pods for the average of the manured plots. The decrease from plots 2 and 4 is much less than that from the control plot.

LOUIS D'OR ESTATE.

As mentioned in last year's report, the Castilloa rubber trees have been cut out from the plots on this estate during the past year, and the cacao trees have greatly improved in consequence.

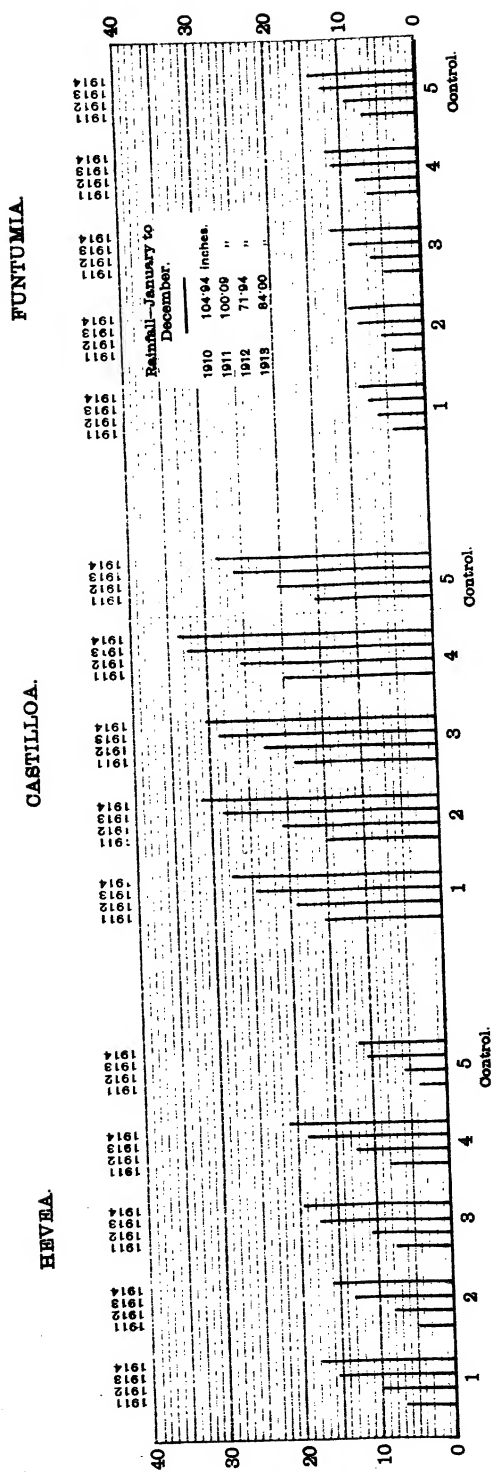
The manures were applied in July, 1913, the kind and quantity applied to each plot is shown in Table XXVII.

TABLE XXVII—CACAO EXPERIMENTS—LOUIS D'OR ESTATE TOBAGO.

Plot.	Number of trees.	Manures applied each year from 1911.	Per Plot.			
			Cost of manuring.	NUMBER OF PODS PICKED SEP. 1, TO AUG. 31.		
				1911-12.	1912-13	1913-14.
1	58	{ 11,600 lb. Mulch 58 „ Sulph. ammonia 58 „ „ of potash }	\$ c. 7.23	142	118	†
2	57	{ 57 lb. Sulph. of potash 114 „ Bone meal }	3.57	124	154	429
3	56	{ 56 lb. Sulph. ammonia 56 „ „ of potash 112 „ Superph. of lime }	5.04	154	188	878
4	56	Control No manure	..	100	67	596

Vide Table I (foot note.) † Rubber trees cut out in August 1913.

Diagram VI.—Comparative girth of Rubber Trees in inches for four years at Roxborough Estate—Tobago.



EXPLANATION.—The plots are indicated by the numbers 1, 2, 3, etc.
Each distance from 0 to 10, 10 to 20, etc., represents ten (10) inches in girth and therefore the distances from any one horizontal line to the next is equivalent to one (1) inch.

ROXBOROUGH ESTATE. — (Mixed Hevea, Castilloa and Funtumia Rubber).

The plots have received the same manurial and cultural treatment as previously. The manures were applied in June, 1914. The girth of the trees was measured on March 14, 1914, the average for each plot has been calculated and the results are recorded in Table XXVIII.

TABLE XXVIII.—RUBBER EXPERIMENTS.—ROXBOROUGH ESTATE, TOBAGO.

Trees about 5 years old in 1911.

Plot.	Description of trees.	Number of trees.	Manures applied per tree each year from 1911.	Cost of manuring per plot.	AVERAGE GIRTH OF TREES 3 FT. ABOVE THE GROUND.			
					Mar., 1911.	Mar., 1912.	May, 1913.	Mar., 1914.
				£ c.	Ins.	Ins.	Ins.	Ins.
1	Hevea ...	10	100 lb. Pen manure ...	1.15	6.5	9.8	15.2	17.8
	Castilloa ...	12		1.38	15.2	19.2	24.4	27.9
	Funtumia ...	11		1.26	4.3	6.0	7.7	8.7
2	Hevea ...	9	2 lb. Sulph. of ammonia 1 „ Sulph. of potash	0.94	4.9	7.9	13.0	15.7
	Castilloa ...	10		1.04	14.7	20.9	28.4	31.1
	Funtumia ...	5		0.52	4.1	5.8	8.3	10.0
3	Hevea ...	9	Wild indigo planted for shading the ground	0.50	7.1	10.7	17.5	19.6
	Castilloa ...	10		0.55	19.0	22.7	28.7	30.5
	Funtumia ...	6		0.39	5.0	6.9	9.5	12.0
4	Hevea ...	5	Mulch ...	0.23	8.0	12.2	18.6	21.0
	Castilloa ...	9		0.42	20.0	25.8	32.5	33.8
	Funtumia ...	7		0.32	7.0	8.4	11.2	12.3
5	Hevea ...	7	Control—No manure	...	3.3	5.3	10.4	11.4
	Castilloa ...	12		...	15.1	20.4	26.1	28.3
	Funtumia ...	10		...	7.1	9.6	13.0	14.2

The average girth of the Hevea, Castilloa and Funtumia trees respectively for the different plots, during the past four years, is shown graphically in diagram VI.

METEOROLOGY.

RAINFALL RETURN FOR FEBRUARY, 1915.

Stations.	February, 1915.	February, 1914.	JAN. TO FEB.	
			1915.	1914.
<i>North-west District.</i>				
	Ins.	Ins.	Ins.	Ins.
St. Clair—Royal Botanic Gardens ...	0.66	0.61	2.76	1.11
Port-of-Spain—Colonial Hospital ...	0.27	1.04	1.62	1.45
" Royal Gaol ...	0.45	1.31	2.43	1.82
" Constabulary Hdqr's. ...	0.16	1.49	1.10	2.17
St. Ann's—Reservoir ..	0.43	1.66	4.18	2.15
Maraval—	0.88	1.52	3.17	2.15
" Constabulary Station ...	0.03	1.07	2.46	1.67
Diego Martin—Constabulary Station...	0.70	1.23	2.92	1.66
" Waterworks ...	1.11	0.80	3.03	1.66
" River estate ...	1.04	0.96	1.88	1.54
Fort George Signal Station ...	0.25	1.26	2.67	1.91
North Post ..	1.22	1.00	1.45	1.88
Carenage Constabulary Station ...	0.34	1.08	2.52	1.71
Carrera Island Convict Depôt ...	0.11	0.80	0.70	1.62
Chacachacare Lighthouse ...	0.44	1.08	2.19	1.92
<i>Santa Cruz—Maracas District.</i>				
Santa Cruz—Constabulary Station ...	0.24	1.41	2.60	2.19
St. Joseph—Government Farm ...	0.23	1.38	2.73	2.47
" Constabulary Station ...	0.03	1.56	2.42	2.14
Tunapuna—St. Augustine estate ...	0.48	1.76	2.57	2.92
Maracas—Government School ...	0.00	1.15	2.95	2.47
" Ortinola estate ..	0.52	2.99	3.61	4.34
Caura—Wardour estate ...	0.37	1.44	2.25	2.60
<i>West Central District.</i>				
Caroni—Frederick estate ...	0.40	3.10	2.97	9.08
Chaguanas—Constabulary Station ...	0.35	1.98	3.04	3.45
" Woodford Lodge estate ...	0.41	2.20	3.20	3.76
Carapichaima—Waterloo estate ...	0.15	1.69	3.54	2.92
" Friendship Hall estate ...	0.45	2.45	5.00	3.69
Conva—Exchange estate ...	0.63	0.66	5.62	1.45
" Brechin Castle estate ...	0.73	1.06	4.89	2.20
" Perseverance ..	0.43	1.57	4.29	2.50
" Camden ..	1.01	0.97	4.48	1.55
" Milton ..	0.88	0.47	6.09	1.48
" Spring ..	0.78	1.93	5.54	2.98
" Constabulary Station ...	1.14	0.34	5.40	1.18
" Esperanza estate, San Antonio...	0.33	0.33	5.66	1.28
<i>San Fernando & Princes Town District.</i>				
Claxton's Bay—Forbes Park estate ...	0.33	0.88	4.84	1.76
Pointe-à-Pierre—Bonne Aventure est. ...	0.72	2.16	6.63	3.63
" Concord estate ...	0.78	2.20	7.79	3.22
" Plein Palais estate ...	1.20	0.76	5.17	1.62
Naparima—Picton estate ...	1.56	1.75	7.57	2.39
" Usine St. Madeleine estate ...	1.85	0.88	6.61	1.86
" La Fortunée estate ...	1.22	1.22	5.37	1.87
" Lewisville, San Fernando..	1.86	1.32	8.20	2.78
" Tarouba estate ...	1.27	0.78	9.66	1.73
" Union Hall ..	0.68	1.35	4.20	2.59
" Palmiste ..	1.01	1.33	5.59	2.19
" Hermitage ..	0.80	2.07	5.61	2.85
Princes Town—Craignish ..	1.21	2.70	7.04	4.16
" Cedar Hill estate ...	2.18	1.83	6.78	3.77
" Williamsville estate ...	1.05	2.16	7.34	5.18
" Esmeralda Estate ...	0.72	3.41	7.29	5.45
" New Grant estate ...	1.28	2.31	9.77	4.75
" Constabulary Station...	2.50	0.91	6.04	1.85
" Hindustan estate ..	0.73	2.62	7.08	4.23
" La Retraite estate ...	1.56	4.36	10.68	9.06

RAINFALL RETURN FOR FEBRUARY, 1915.—CONTD.

Stations.	February, 1915.	February, 1914.	JANY. TO FEBY.	
			1915.	1914.
<i>San Fernando and Princes Town District.—(Cont'd.)</i>	Ins.	Ins.	Ins.	Ins.
Princes Town—Malgretoute estate ...	1.77	1.94	6.96	3.49
Savana Grande—Friendship & Ben Lémond estates ...	1.10	1.64	6.87	2.99
Poole—El Rosario estate ...	1.40	3.79	9.35	5.58
<i>Montserrat District.</i>				
Montserrat Constabulary Station ...	0.30	1.55	5.56	2.04
Brasso—La Vega estate ...	0.34	2.69	6.74	5.55
<i>Arima District.</i>				
Arima—Warden's Office ...	1.45	2.33	2.12	4.21
„ Torrecilla estate ...	0.24	3.89	3.78	6.21
„ Verdant Vale estate ...	0.27	2.44	4.98	4.13
San Rafael—Constabulary Station ...	0.34	5.05	5.81	6.97
Guanapo—Talparo estate ...	0.59	3.35	6.28	5.12
„ San José Estate ...	0.97	...	8.60	...
Tamana—Sta. Marta estate ...	0.85	3.55	9.29	6.34
<i>South-west District.</i>				
Oropucho—Constabulary Station ...	1.17	1.89	8.63	2.74
„ Pluck estate ...	1.19	2.09	7.27	2.43
Siparia—Constabulary Station ...	3.45	4.80	9.87	6.95
„ Alta Gracia ...	2.16	...	6.98	...
Guapo—Adventure estate ...	1.30	0.80	4.94	1.55
Point Fortin—Constabulary Station ...	1.74	1.10	6.51	2.79
Erin—La Ressource estate ...	3.10	1.04	7.82	3.27
„ Industry estate ...	1.39	1.31	5.40	4.17
Cedros—Constabulary Station ...	2.00	1.57	5.05	3.54
„ Perseverance estate ...	1.91	1.80	5.18	3.58
Idacos—Constance estate ...	1.75	0.69	4.50	1.93
Irois—Irois estate ...	2.70	2.64	8.48	4.81
<i>South Coast.</i>				
Moruga—Constabulary Station ...	0.94	1.95	4.96	3.43
<i>North Coast.</i>				
Blanchisseuse—Constabulary Station ...	0.22	3.08	4.72	4.66
Grande Rivière—Mon Plaisir estate ...	2.35	4.55	5.45	7.15
Toco—Aragua House ...	1.26	2.91	6.04	5.14
„ Constabulary Station ...	0.30	3.42	3.57	5.16
Point Galera—Light House ...	0.16	1.84	1.61	2.43
<i>East Coast.</i>				
Matura—La Juanita estate ...	0.53	2.62	4.06	4.82
Manzanilla—Constabulary Station ...	1.18	2.27	7.33	5.09
Sangre Grande—Sta. Estella estate ...	0.83	3.07	5.77	7.29
„ New Lands estate ...	0.71	2.58	9.53	6.13
„ Evasdale estate ...	1.32	4.12	7.59	7.24
„ Grosvenor estate ...	1.17	3.56	8.15	6.11
Mayaro—Constabulary Station ...	0.30	1.49	6.51	3.21
<i>Tobago.</i>				
Tobago—Hermitage estate ...	1.07	3.02	4.87	6.31
„ Riversdale „ ...	1.47	...	5.13	...
„ King's Bay „ ...	0.76	3.14	5.65	6.60
„ Roxburgh ...	1.08	3.80	7.81	7.29
„ Lure estate ...	1.84	3.16	8.09	7.71
„ Botanic Station ...	1.10	1.26	5.12	3.54
„ Government Farm ...	0.19	0.53	2.79	1.51
„ Lowlands estate ...	0.48	1.76	4.17	2.74
„ Friendship estate ...	0.47	2.56	4.27	4.02
„ Bon Accord estate ...	2.95	...	3.52	...

BOTANICAL.

ORCHIDS FLOWERING DURING THE MONTH
OF FEBRUARY 1915.

-
- | | | |
|---|-----|--|
| 1. <i>Brassavola nodosa</i> (L.) Lindl. | ... | ... West Indies, and
Central America, &c. |
| 2. <i>Bulbophyllum pachyrachis</i> (A. Rich) Griseb | ... | Trinidad. |
| 3. <i>Cattleya Skinneri</i> Lindl. var. <i>parviflora</i> Hook. | ... | Trinidad. |
| 4. „ <i>labiata</i> Lindl. var. <i>Gaskelliana</i> Hort.
Sander | ... | ... Tropical America. |
| 5. <i>Diacrium bicornutum</i> (Hook) Benth | ... | ... Trinidad & Tobago. |
| 6. <i>Dendrobium</i> sp. (Flowers white) <i>lasting but a
few hours</i> | ... | ... India. |
| 7. „ <i>sanguinolentum</i> Lindl. | ... | ... Penang. |
| 8. <i>Epidendrum globosum</i> Jacq | ... | ... Trinidad & Tobago. |
| 9. „ <i>atropurpureum</i> Willd. (<i>E. macrochilum</i>
Hook | ... | ... Trinidad. |
| 10. „ <i>stenopetalum</i> Hook | ... | ... Trinidad & Tobago. |
| 11. „ <i>rigidum</i> Jacq. | ... | ... „ „ |
| 12. „ <i>strobiliferum</i> Rehl. f. | ... | ... „ „ |
| 13. <i>Gongora quinquenervis</i> Ruiz et Pav. (<i>G.
maculata</i> Lindl.) | ... | ... Trinidad. |
| 14. <i>Ionopsis utricularioides</i> (Sw.) Lindl.... | ... | ... Trinidad & Tobago. |
| 15. <i>Lockhartia elegans</i> Hook | ... | ... Trinidad. |
| 16. „ <i>acuta</i> (Lindl.) Rehb. f. | ... | ... „ |
| 17. <i>Maxillaria rufescens</i> Lindl. | ... | ... Trinidad & Tobago. |
| 18. <i>Oncidium ampliatum</i> Lindl. “ <i>Yellow bee.</i> ” | ... | Trinidad. |
| 19. „ <i>guttatum</i> (L.) Rehb. f. (<i>O. luridum</i> Lindl.)
“ <i>Brown bee.</i> ” | ... | ... Trinidad & Tobago. |
| 20. „ <i>Lanccanum</i> Lindl. “ <i>Cedros bee</i> ” | ... | Trinidad. |
| 21. „ <i>Papilio</i> Lindl. “ <i>Butterfly Orchid</i> ” | ... | “ |
| 22. „ <i>pusillum</i> (L.) Rehb. f. (<i>O. iridifolium</i>
Kunth). | ... | ... „ |
| 23. <i>Ornithocephalus gladiatus</i> Hook | ... | ... Trinidad & Tobago. |
| 24. <i>Pleurothallis</i> sp. | ... | ... Trinidad. |
| 25. „ „ | ... | ... „ |
| 26. <i>Rodriguezia secunda</i> Kunth | ... | ... Trinidad & Tobago. |
| 27. <i>Sobralia</i> sp. (<i>terrestrial</i> | ... | Trinidad. |
| 28. <i>Spiranthes acaulis</i> (Smith) Cogn. (<i>terrestrial</i>) | ... | ... Trinidad & Tobago. |
| 29. <i>Bletia alta</i> (L.) Hitchc. (<i>B. verecunda</i> R. Br.)
(<i>terrestrial</i>) | ... | ... West Indies, etc. |
| 30. <i>Trizeuxis falcata</i> Lindl. | ... | ... Trinidad. |
| 31. <i>Vanda tricolor</i> Lindl. | ... | ... Java. |

W. E. B.

NOTES.

TOBACCO.

The exports of tobacco from Tobago for 1914 show a very satisfactory increase over previous years. The following are the exports from 1902. The export of cigars began in 1910.

	<i>Tobacco.</i>		<i>Tobacco.</i>	<i>Cigars.</i>
1902	3,699 lb.	1909	3,149 lb.	...
1903	3,066 „	1910	13,549 „	426 lb.
1904	1,681 „	1911	4,385 „	542 „
1905	8,172 „	1912	2,461 „	18 „
1906	2,714 „	1913	15,309 „	54 „
1907	3,867 „	1914	48,171 „	203 „
1908	6,479 „			

RAINFALL.

On the 29th April the first heavy shower of the year fell but was confined to a remarkably small area. The returns show :—

St. Augustine Estate (Tunapuna)	...	... 3.34 inches.
Frederick Estate (Caroni)	...	... 3.23 „
Constabulary Station (St. Joseph)	...	... 2.30 „
Government Farm ( „ )	...	... 1.85 „
Constabulary Station (Chaguanas)	...	... 1.05 „
Woodford Lodge Estate ( „ )	...	... 0.98 „
Ortinola Estate (Maracas)	..	... 0.90 „

No other station with the exception of Concord Estate Pointe-à-Pierre, (1.40 inches) reported a rainfall approaching 1.00 inch, and the majority of the Stations reported no rainfall.

Notwithstanding this it appears probable that this was the beginning of the rainy season which has set in early this year,

ST. AUGUSTINE ESTATE.

Mr. A. P. Daly has been appointed Clerk and Cashier at St. Augustine Estate.

ASSISTANT INSPECTOR, PLANT PROTECTION ORD.

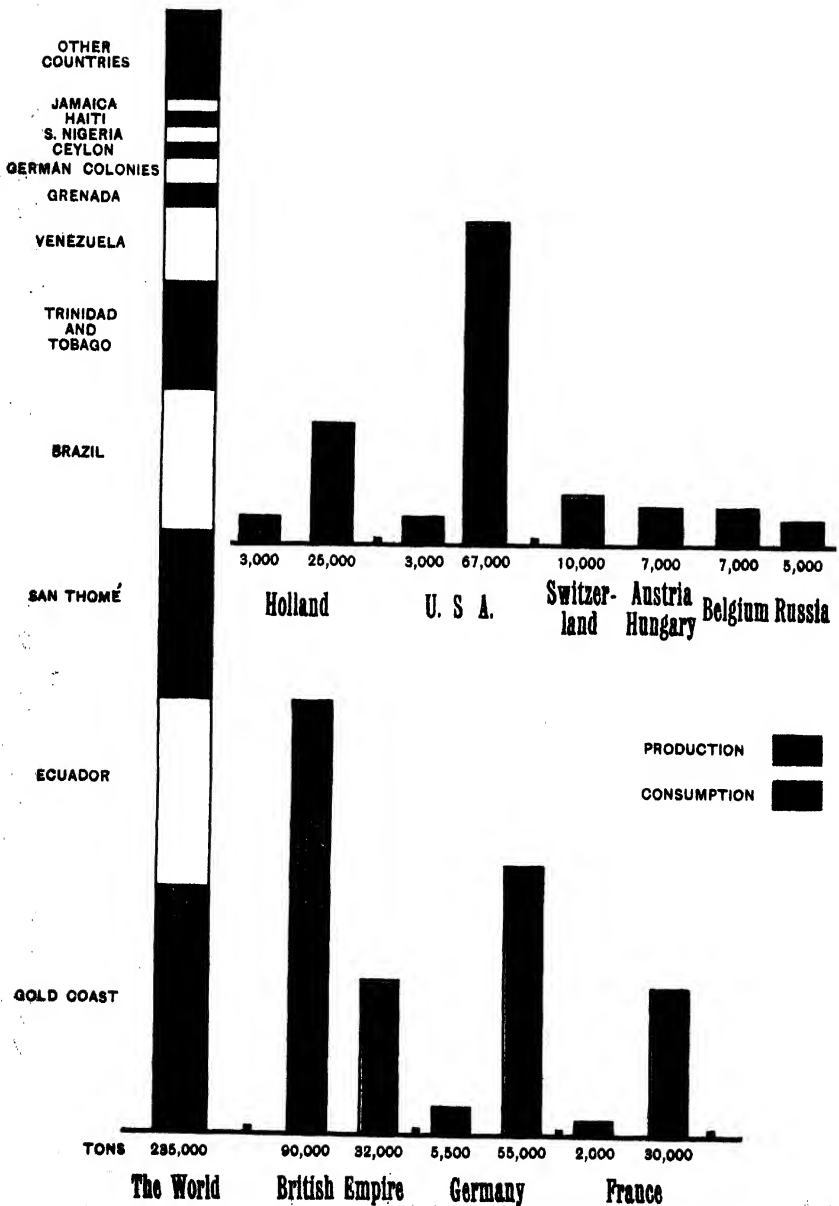
Mr. H. A. Gordon has been appointed Assistant Inspector under the Plant Protection Ordinance in succession to Mr. V. A. Renwick who has been selected for the post of Horticultural Overseer in the Department of Agriculture for Nigeria. Mr. Gordon took up his duties on June 1.

(*Bulletin, Department Agriculture Trinidad & Tobago*, pp. 69-102. Issued June 16, '15).

DIAGRAM I.

CACAO

PRODUCTION & CONSUMPTION



BULLETIN

OF THE
DEPARTMENT OF AGRICULTURE,
Trinidad and Tobago.

PART 4.]

1915.

[VOL. XIV.]

THE INFLUENCE OF THE WAR ON TROPICAL AGRICULTURE.*

BY W. G. FREEMAN, B.Sc., A.R.C.S., F.L.S.,
Assistant Director of Agriculture.

THE subject of the influence of the War on Tropical Agriculture is a large and complex one, on which I cannot claim more than general knowledge. I do not propose therefore to attempt to cover the whole ground, but merely to endeavour to bring forward a few points with reference to products in which we are most interested in this colony.

In the first place I will refer to the great stimulus which the war has given to local production of foodstuffs in many parts of the world. It is always a question in the West Indies as to whether it is wiser to grow foodstuffs for our consumption, or to grow crops for export in exchange for imported foods. In the olden days, when sugar fetched high prices, it was probably better policy to export sugar and import other materials, but under normal conditions now, we should aim at a greater measure of self-support. In the West Indies and some other tropical countries this question of foodstuffs is closely associated with cotton cultivation. In St. Vincent the Government ginnery is being turned into an organization for the purchase of corn. The people, who quite understand the working of the factory along co-operative lines, are being encouraged to bring their corn and sell it for a fixed price, with a bonus at the end of the year according to the profits made by the factory. In India wheat is being substituted for cotton this year, and in Egypt they have gone further and legislation has been introduced preventing cultivators from planting more than one-fourth of their area in cotton; the remainder being planted in corn, wheat, beans and other crops of that character.

The war has affected our fruit industry owing to the difficulty of the steamers finding proper accommodation for the handling of a perishable product. Curiously enough in British Honduras, a fillip has been given to agricultural education. The war has interfered with the export of mahogany on which that colony largely depends. Steps have been taken to import suitable machines, and an agricultural demonstration farm has been formed for the purpose of giving practical instruction in the growing of foodstuffs which before was neglected in that colony.

To turn now to the principal products of Trinidad and Tobago:

CACAO.

I will draw your attention to diagram No. 1 which illustrates the production and consumption of cacao. The first column represents the

* A paper read before the Agricultural Society on March 15, 1915, and reprinted from "Society Paper" No. 622. *Proceedings, Agricultural Society, Trinidad and Tobago*, Vol. XV pp. 162-9.

total annual production of cacao in the world, 285,000 tons produced in order of quantity from the Gold Coast, Ecuador, San Thomé, Brazil, Trinidad and Tobago, Venezuela, Grenada, German Colonies, Jamaica, etc. It will be seen that Trinidad comes fifth amongst the cacao producing countries of the world. I will endeavour to show how the matter stands for three of the principal Empires concerned in the present war. As seen by the diagrams, the British Empire produces per annum 90,000 tons, of cacao, whereas it is consuming about 32,000 tons, leaving a surplus of about 60,000 tons for export to other countries. In Germany the case is absolutely different. She produces 5,500 tons and consumes 55,000. France produces 2,000 and consumes 30,000. Of the other countries actually engaged in hostilities, Russia consumes 5,000 tons and produces none, Belgium consumes 5,000 tons and produces none, and Austria-Hungary consumes 5,000 and produces none. The United States produces 3,000 tons and consumes 67,000, Holland produces 3,000 tons and consumes 25,000, and Switzerland consumes 10,000 tons and produces none. It is thus evident at a glance how very different the position is with these different Empires. The British Empire is alone amongst the belligerents in producing cacao in excess of its requirements. When the Home Government prohibited the export of cacao to the other belligerents, it struck at their own interests, because although we have a large surplus, there are neutral countries which one cannot influence by a prohibition order and the effect would be to deflect the trade to certain neutral countries and stop the tendency to make London and the United Kingdom the great cacao centre of the world.

COPRA.

Leaving cacao, let us turn to another tropical product--copra,—in which the position is a little more complicated. I will not attempt to deal with coconuts as a whole because they come into the market in many different forms. But if we take copra itself, with regard to France, Austria-Hungary, Germany and the United Kingdom, diagram No. 2 brings out some points of interest. Germany and France are two of the countries in Europe which have long been great centres for oil—Hamburg and Marseilles being two of greatest oil crushing centres of the world. Germany imported about 230,000 tons of copra per year, of which 124,000 tons came from various parts of the British Empire. Austria-Hungary imported 84,000 tons getting 29,000 from British sources and only 5,000 from foreign countries; France imported 153,000 tons, getting 20,000 from British sources, 10,000 from French colonies, 43,000 from the Dutch East Indies, 73,000 from the Philippines, and the balance from other countries. That trade has been practically stopped altogether and copra is no longer exported from British sources into Germany and Austria, so that to a certain extent British coconut producers have lost important markets. It does not affect us so much because from this colony we export but little copra. A curious situation has arisen because although Germany imported this large amount of copra from British sources, she also exported coconut oil to the extent of 41,000 tons per annum, no less than 30,000 going into the United Kingdom, because it does not manufacture enough coconut oil for itself, but imports from foreign countries to an extent equivalent to 32,000 tons of copra per annum. If the oil plants in

DIAGRAM II.

IMPORTS OF COPRA

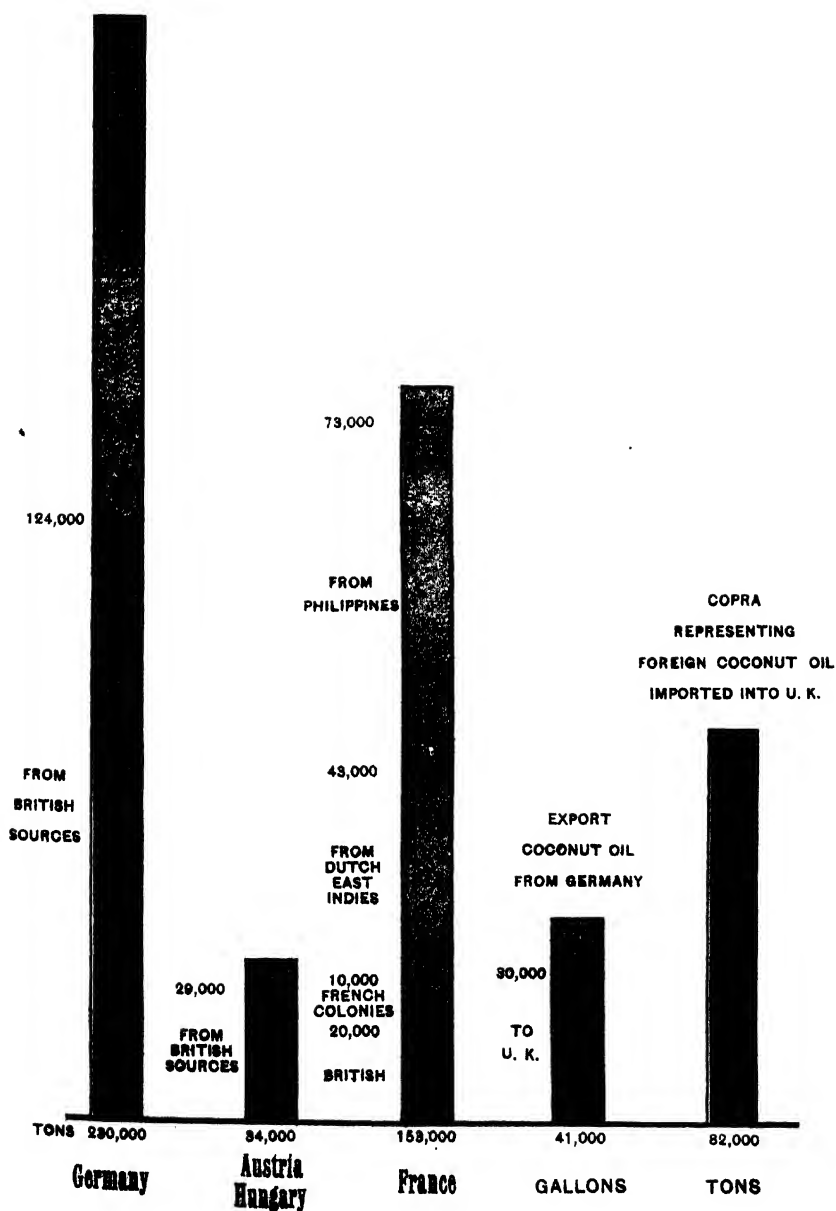
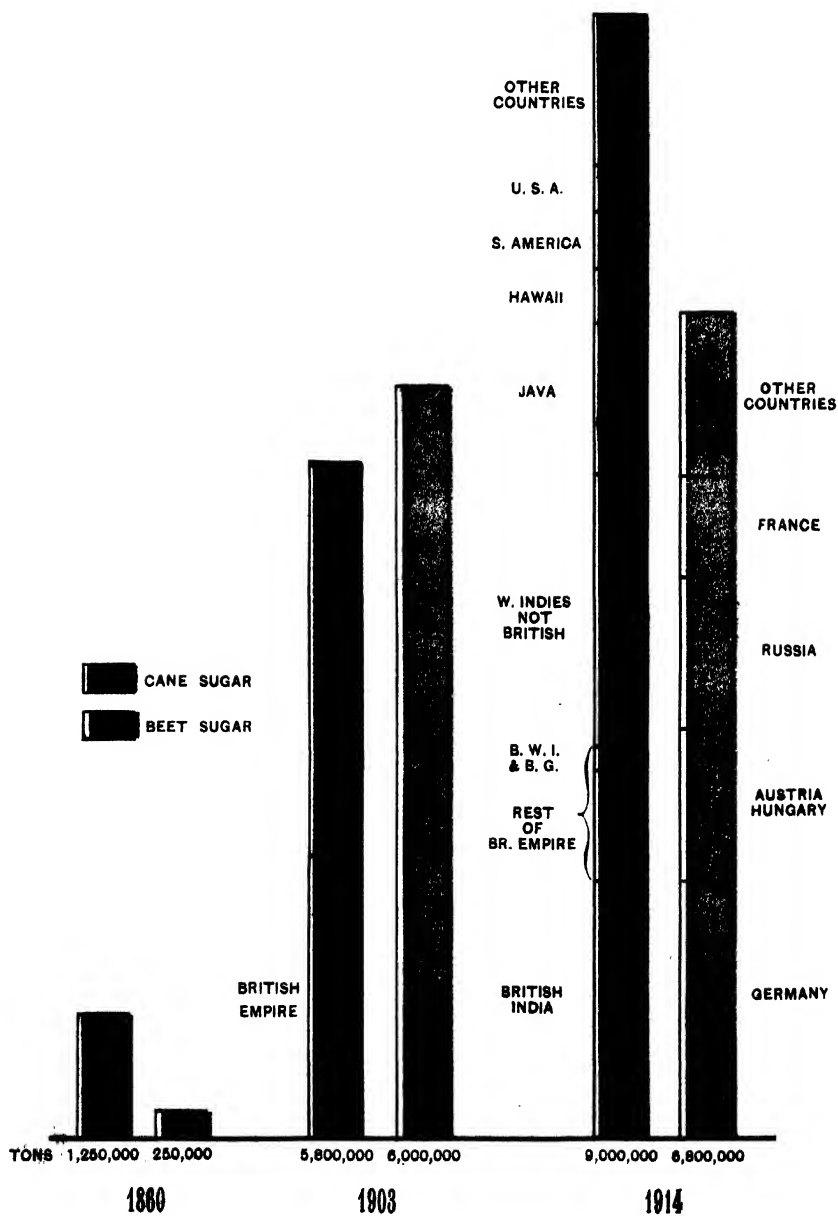


DIAGRAM III.

**THE WORLD'S
PRODUCTION OF SUGAR**



England could readily be adapted to the manufacture of coconut oil from copra. they could take over the very large amount which formerly went to Germany and Austria and for which the market has been lost. The Imperial Institute in London is interesting itself in this matter with its new Technical Information Bureau, and is endeavouring to put people who are interested in the manufacture of copra into touch with exporters in various countries. The Department of Agriculture, at the request of the Imperial Institute and through the kindness of the Chamber of Commerce, has supplied the names of the chief copra exporters in this colony and of their London representatives.

SUGAR.

The last of the products I propose to deal with is sugar, and if you will allow me, I would like to say something of its past history. If you go back further, more than one hundred years, we know that the sugar cane was the dominant plant and the sole source of sugar for the civilized world. Still earlier, in 1747, a German chemist, Marggraf, had shown the possibility of getting sugar from the beet. In 1797 a French refugee, Achard, continued the work, and about the beginning of the last century the first experimental factory for beet was started in Silesia with a capacity of something like 525 tons of roots a year, which would probably produce about 30 tons of sugar. The baby-hood of the beet industry was greatly affected by continental wars. Napoleon as you are probably aware attempted to stifle England's commerce by a continental blockade, his main object being to keep out from Europe the products of the British colonies (which at that time were chiefly cotton, sugar and indigo). The result of this was a great impetus to the beet industry and Napoleon himself in 1811 ordered that 80,000 acres in France be planted in beet. The industry flourished for a time and in 1812 there were forty beet sugar factories producing 10,000 tons of sugar per annum. After the Napoleonic wars, the industry dropped again and in 1829 the beet sugar production was only 4,000 tons. In 1835 Germany also took up the industry seriously. By 1860 the world's production of sugar was 1,500,000 tons, cane sugar 1,250,000 and beet 250,000. Both France and Germany seriously fostered the beet industry, and it is very interesting to follow the results of the more scientific taxation of Germany as compared with the cruder method of France. Germany encouraged the industry along lines which gave great incentive to research by botanist, chemist and engineer, by levying duties not on the amount of sugar which the factory produced, but on the amount of roots which were taken in. In France, on the other hand, the tax was put on the amount of sugar produced. There was therefore a greater incentive in Germany to improve the sugar contents of the beet, and also the factory methods in order to get the maximum amount of sugar from the minimum quantity of beet, thus escaping taxation. The results were very marked. In 1871 France, produced 284,000 tons of sugar and Germany produced 186,000 tons, the beet in both containing about 6 per cent. of sugar. By 1884 the German production had gone up to over 1,000,000 tons, whereas the French production had gone slightly back, from 284,000 to 265,000. Still more striking was the improvement effected in the beet. In 1871 the roots in both countries contained about 6 per cent. of sugar; in 1884 those in France had not

improved, whilst in Germany the sugar contents had been raised to 11 per cent. France then adopted the German system and taxed the roots which went into the factory. Thirteen years later the production in France had gone up to 1,500,000 tons and Germany to 1,850,000 and the sugar contents of the beet from 8 to 11 per cent. in France, and in Germany from 11 to 12·63 per cent. During a great part of this period there has been in both countries a "drawback" on sugar exported. By 1892 Germany altered her system from a duty on roots to a duty on sugar with a direct bounty or bonus of £5 per ton on exports. The other continental countries worked on more or less similar lines, and as a general result the beet industry increased from 250,000 tons in 1860 to 6,000,000 tons in 1908. During the same period the sugar cane production had grown from 1,500,000 to 5,800,000. In 1908 the Brussels Convention of 1902 became operative. It abolished the bounty on beet sugar. The result was a great stimulus to cane sugar. By 1914 beet had only gone up from 6,000,000 to 6,800,000 whereas cane sugar had progressed from 5,800,000 to 9,000,000. The world's production of sugar and the relative importance, past and present, of cane and beet are shown in diagram 8.

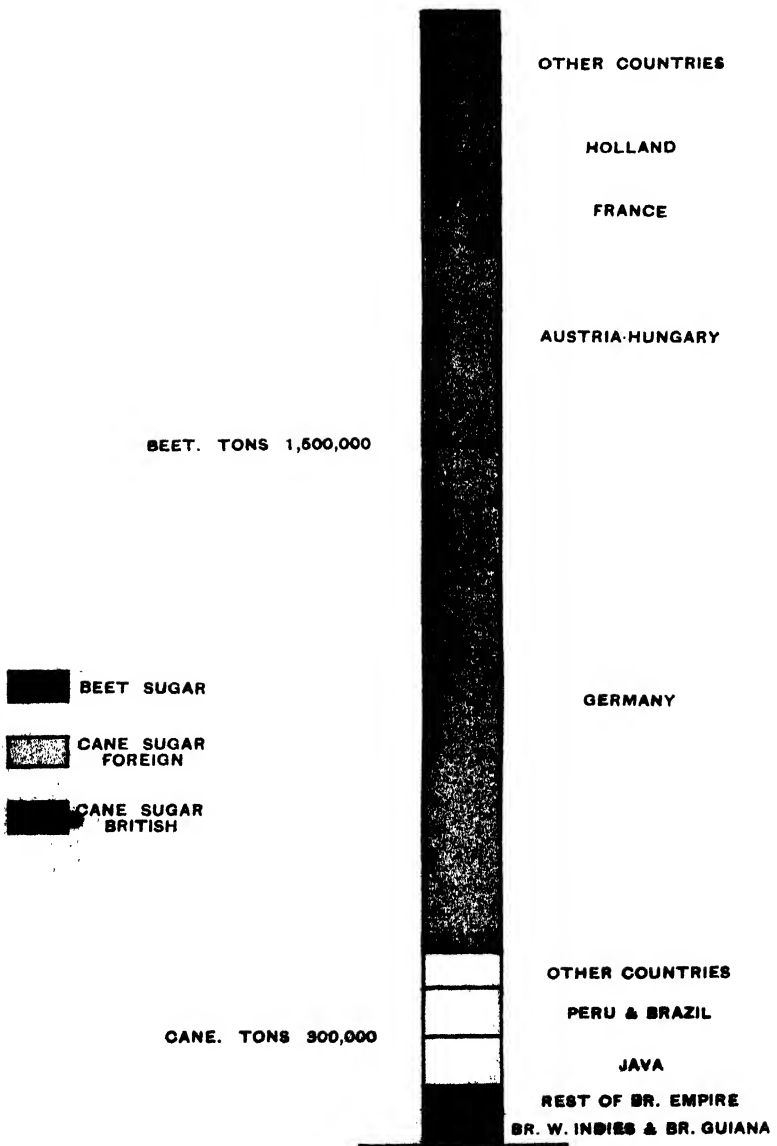
At the present time Germany and Austria produce more sugar than the whole of the British Empire. The total amount of sugar used annually in the United Kingdom is 1,800,000 tons; beet 1,500,000, and cane sugar only 300,000, of which only a small amount comes from the British Empire, and the rest from foreign countries. The relative proportions are shown in diagram 4. In the British Empire the sugar position is thus entirely different from that of cacao. The British Empire is very largely dependent on foreign sources of supply for its sugar. The Brussels Convention put an end to the artificial stimulus given to the beet sugar industry and since 1908 beet and cane sugar have competed on equal terms—as far as they can be equal. Beet has the great natural advantage that it is produced near the great centres of consumption and thus has a natural protection in the form of cheaper freights. Beet sugar has one great disadvantage, its impurities are very objectionable compared with those in cane sugar. I might mention in illustration that Mr. Aspinall, the energetic Secretary of the West India Committee used to have two bottles on his office shelf, one of raw cane sugar and the other of raw beet sugar. After keeping the latter for a short time it developed a most offensive odour, and he would invite people to smell the contents of those bottles, while the beet sugar bottle afforded a readily available source of punishment for the office boy.

At the outset of the war, the Home Government was faced with a shortage in sugar supplies; it acted promptly and purchased 900,000 tons of sugar at £20 per ton (at a total cost of £18,000,000, the biggest sugar deal ever made in the world. It has also prohibited the importation of sugar from other countries, for the reason that importation from a neutral country such as Holland might be merely a means of passing German sugar through that country to England. West Indian sugars as you are aware can be imported by license.

From the most recent accounts, it does not seem that the war up to the present, except in northern France, has very seriously affected the beet sugar output, and therefore the immediate difficulty in Europe is not so much the production of sugar, as getting rid

DIAGRAM IV.

UNITED KINGDOM
SOURCES OF SUGAR SUPPLIES



of it. Accordingly much is being stored, causing demand for proper storage facilities as there is a lack of suitable warehouse accommodation for very large quantities of sugar. In one of his very interesting letters in the *Louisiana Planter* Mr. P. Geerligs describes how Belgian refugees have been turned out of warehouses in Holland in order to make room for sugar.

Diagram 4 illustrating the United Kingdom sources of sugar is particularly worthy of consideration in this colony with regard to the present difference of opinion between cane farmers and factory owners. If the war suddenly came to an end the situation would be that a very large quantity of German and Austrian sugar would be dumped on the home market unless there was some sudden change in the fiscal policy of the United Kingdom. So that unless the war goes on for a comparatively long period, over this year, there is no guarantee that the present prices of sugar will be maintained. Supplies in England are said to be sufficient to last until May, but an early peace will liberate large quantities of sugar with a consequent drop in prices. Speaking in the House of Commons early in February, Mr. Asquith, the Prime Minister, announced that any change in the price of sugar in the next few months is likely to be downward. There is thus distinct uncertainty as to the price of sugar this year; and after that, assuming that the war does not continue, there is no sign of any permanent increase in the prices unless there is an alteration in feeling in Imperial matters, and steps are taken to ensure that the British Empire shall not be so dependent upon foreign countries for one of the staples of life, *i.e.*, by some form of preference to sugar whether cane or beet, produced in the British Empire. This probably, involves an increase in the price of sugar, to the home consumer. Failing this, if the struggle is to be between cane and beet on equal terms, then in Trinidad we have to aim at producing sugar at as cheap a rate as the best cane sugar countries, *i.e.*, Java and Cuba. This can only be done by the exercise of unremitting care and attention to all branches of the cane industry, the selection of canes, their cultivation and manufacture. It is possible that if we only had some form of scientific taxation on the lines on which the Germans encouraged their beet industry, the sugar cane industry of the colony would also make much more rapid strides than during the last fifty years.

I have attempted in this inadequate manner to bring before you some points which I hope are of interest with regard to products in which we are all interested. I shall be content if I have succeeded in placing some facts about these products in their true perspective. One cannot always realize the significance of figures and therefore I have attempted to put them in a graphic form in which they are more readily understood.

SUGAR.

BRITISH GROWN SUGAR.

Report of the Chamber of Commerce and the Agricultural Society.

The preceding number of this *Bulletin* (Vol. XIV. pp. 69-78) contained the report of the Sugar Committee of the Board of Agriculture on the possible extension of the sugar industry of the colony.

This important matter is also dealt with in the following report to the West India Committee of a Joint Committee of the Chamber of Commerce, (Incorporated), and the Agricultural Society of Trinidad and Tobago upon the question of placing colonial sugar upon as favourable a footing in English markets as British beet. The report which was adopted at General Meetings of the Chamber and the Society was published in the *West India Committee Circular* for May 18, 1915. (Vol. XXX. pp. 215-6):—

1. The phenomenal rise in the price of sugar which took place on the outbreak of war last year is the strongest confirmation of the long predicted economic danger to the Empire of being almost altogether dependent upon foreign and possible alien countries for the supply of so essential an article of food.

2. Incalculable harm admittedly resulted to the British sugar producing colonies in the past owing to the want of interest or indifference to their welfare displayed by successive ministries other than that of which the late Mr. Joseph Chamberlain was so distinguished a member, to whom the West India Sugar Industry is indebted for existence to-day. The effect of that want of interest or indifference is re-acting now on those who have been supporters of, or who have quietly acquiesced in, a policy which would sacrifice everything on the altar of immediate cheapness. The present abnormal cost of sugar could never have obtained had the sources of British supply been reasonably encouraged, instead of, when not actually penalised, being left in a condition of doubt paralyzing to enterprise.

3. It is too late, for present purposes at any rate, to provide for the yield within the Empire of the nation's demand for sugar at a reasonable cost, and the call of high prices presses on the people when least able to bear it, but looking at the future, an effort is being made by the West India Committee "in view of the high prices which consumers in the United Kingdom are paying as a result of their dependence . . . especially on Germany and Austria for the bulk of their supplies of sugar," to ascertain "what room there is for the expansion of the sugar industry in Trinidad and the sugar colonies."

His Excellency the Governor has submitted the despatch of the West India Committee on the subject to the Board of Agriculture and the Sugar Committee of that body has issued an admirable report dealing with the past, the present, and the future of the industry. This report sums up the situation by the statement:—

(a.) That the increase of the industry depends on the capacity of the factories.

- b.) To increase the capacity of the factories, and to provide additional encouragement to cane farmers, fresh capital is absolutely necessary.
- (c.) But this would not be forthcoming without a guarantee that the market price of sugar would be higher than during recent years.
- (d.) The only way in this guarantee could be secured appears to be that a preference should be given by the Imperial Government to sugar produced in the British Empire.

4. With these views we are in entire accord. In our opinion unless such preference is given, new capital will not be forthcoming and Great Britain is likely in the future to be even more dependent on the European Continent for her supply of sugar than she has been in the past.

5. In the meantime, an influential movement is on foot to establish a beet sugar industry in England, and thus avert the future peril of absence of adequate supply in times of emergency. But the promoters of the movement feel that the prospects of success depend on the assurance of being protected in the future against unfair competitors. They, therefore, asked whether the Government would encourage the industry by exempting home-grown sugar from excise duty for the next ten years. The answer was: "The Government have, of course, no intention in the present circumstances of proposing an excise duty on home-grown sugar."

6. Protests have been made against this announcement on the ground of the preference afforded to sugar produced in Great Britain. On the other hand it may be accepted as a frank and important admission of the principle that the foreigner is no longer to be encouraged at the expense of the home-producer—a principle, the extension of which to the cane sugar colonies of the Empire can hardly now be consistently denied.

7. The privilege of British birth is the common heritage of the British inhabitants of Trinidad as of the British Isles, and that which is accorded to the English farmer cannot in justice be withheld from the British West Indian planter.

8. This Committee, therefore, welcomes the attitude of the Imperial Government in the matter, and recommends that a respectful statement to this effect be made to the Right Honourable the Secretary of State for the Colonies, with the addition of the confident assurance that, in view of the experience resulting from the war, the sugar cane industry of these colonies will be accorded advantages equal to those which are to be given to the beet industry of Great Britain herself.

(Signed) W. GORDON-GORDON,
(Chairman.)

J. BLACK,

W. G. FREEMAN,
ADAM SMITH,
GEO. F. HUGGINS,

J. J. McLEOD,

EDGAR TRIPP,
(Hon. Secretary.)

April 14, 1915.

TESTS OF SEEDLING CANES, 1912-15.*

Results obtained at St. Augustine Estate, Trinidad.

By JOSEPH DE VERTEUIL, F.C.S.,
Superintendent of Field Experiments.

The canes under report grown at St. Augustine during this period consist of plant canes, first and second ratoons. The plant canes received an application of pen manure at the rate of 15 to 20 tons per acre. No manures were applied to the ratoons and in every case the canes received ordinary estate cultivation.

The canes were sampled in the same manner as in the two previous years, that is shoots and green canes were included.

In 1914, the Department imported a three-roller mill, with nine inch rollers, from the Chattanooga Plow Company, Tennessee. This mill has been erected at the Government Farm, St. Joseph, and is driven by a 12 horse-power Petter oil engine. The engine and the mill have been used for the first time this year and have worked satisfactorily. After the canes were crushed, the megass was passed through the mill a second time and an extraction varying from 60 to 70 per cent. obtained according to the varieties of cane.

The analysis of the juice was made between May 6 and 18, 1915, and during this period 8.85 inches of rain were registered on the estate.

Table I gives the results obtained from the plant canes. These include four new varieties imported from Hawaii and only one other variety, the Badilla cane. Unfortunately the field of plant canes at St. Augustine was burnt at the end of April, only the Badilla variety being saved. This was 19 months and the Hawaii varieties 17 months old at the date of reaping.

* The previous report is contained in this *Bulletin*, XIII. 1914, pp. 257-61.

TABLE I.—PLANT CANES—FIELD 4 AND EXPERIMENT PLOTS

Cane.	Date planted.	Area under culti- vation.	JUICE.						YIELD PER ACRE.			Remarks.	
			Per cent. extracted.	Specific gravity	Brix.	Percentage of			Quotient of purity.	lb. sucrose per gal.	Cane, Juice.		Sugar in Juice.
						Sucrose.	Glucose.	Non- sugar.					
H. ?	December, 1913	2,640	65.4	1.0687	16.7	14.04	0.93	1.13	87.7	1,564	33.21	4,552	3.18 Experiment plots.
M. 27	"	1,100	67.1	1.0665	16.2	13.24	1.57	1.39	81.7	1,412	29.70	4,186	"
Badilla	October, "	76,502	63.8	1.0797	19.2	16.83	0.99	1.38	87.6	1,817	22.15	2,932	2.38 Field 4.
H. 146	December, "	3,520	67.4	1.0660	16.1	13.51	1.56	1.03	83.9	1,440	26.14	3,702	2.38 Experiment plots.
H. 227	"	1,100	65.9	1.0626	15.3	11.96	1.68	1.66	78.2	1,271	24.75	3,438	"

* The figures given in these columns for the Badilla were obtained from the Manager of St. Augustine estate.

The results from the first ratoons in Fields 7 and 8 are recorded in Table II. The canes were about twelve months old when reaped. Table III gives the results of these same canes as plants and first ratoons and the average results for the two years are also recorded in this table.

In the first ratoons series—Table II—it will be seen that all the varieties tested, with the exception of T. 89 and B. 9859, have given better results than the Bourbon.

TABLE II.—FIRST RATOONS.—FIELDS 7 AND 8—ST. AUGUSTINE ESTATE.

Canes	Date planted	Area under cultivation.	JUICE.						YIELD PER ACRE.					
			Per cent. extracted.	Specific gravity.	Brix.	Percentage of			Quotient of purity.	Sucre per gal.	Canes.		Juice.	Su- crose in juice.
						Su- crose.	Glu- cose.	Non- sugar.			Tons.*	Galls.		
Badilla, F	June 1912	Sq. feet.	78,750	64.0	1.0859	20.6	18.51	0.99	1.10	89.8	2.010	23.56	3,110	2.79
R. 7169	" "	4,750	65.6	1.0797	19.2	17.32	0.87	1.01	90.2	89.8	1.870	23.04	3,136	2.62
B. 3922	" "	4,750	66.6	1.0660	16.1	13.83	1.24	1.03	85.9	90.2	1.474	27.29	3,819	2.51
T. 202	" "	7,000	68.3	1.0810	19.5	17.83	0.85	0.82	91.4	89.4	1.927	20.53	2,820	2.42
B. 208	" "	5,500	65.6	1.0813	19.6	17.53	1.04	1.03	89.4	89.4	1.896	20.69	2,811	2.38
T. 75	" "	4,750	65.9	1.0730	17.7	15.15	1.18	1.37	85.6	85.6	1.625	23.84	3,280	2.8
T. 109	" "	9,500	66.3	1.0709	17.2	13.93	2.14	1.13	81.0	81.0	1.492	24.36	3,378	2.25
D. 116	" "	9,500	69.1	1.0757	18.3	15.84	1.31	1.15	86.5	86.5	1.704	20.40	2,935	2.23
B. 6836	" "	4,750	66.5	1.0810	19.5	17.83	0.84	1.33	91.4	91.4	1.927	17.42	2,900	2.76
B. 376	" "	4,750	65.2	1.0713	17.3	15.61	0.79	0.90	90.2	90.2	1.672	19.94	2,718	2.03
B. 6450	" "	4,750	70.4	1.0682	16.6	14.58	0.98	1.04	87.8	87.8	1.557	19.03	2,793	1.94
B. 16852	" "	4,750	68.5	1.0626	15.3	12.11	2.42	0.77	79.1	79.1	1.267	23.15	3,843	1.92
D. 116	" "	5,350	62.2	1.0709	17.2	14.40	1.59	1.21	83.7	83.7	1.542	21.11	2,746	1.89
F 3412	" "	4,750	68.3	1.0652	16.6	13.46	2.16	0.98	81.1	81.1	1.438	19.94	2,856	1.83
B. 3390	" "	4,750	65.7	1.0660	16.1	13.14	1.72	1.24	81.6	81.6	1.401	20.40	2,816	1.76
B. 4678	" "	4,750	67.4	1.0665	16.2	13.21	1.80	1.19	81.5	81.5	1.409	18.23	2,581	1.62
Bourbon	" "	24,050	69.7	1.0682	16.6	12.89	1.75	1.96	77.6	77.6	1.377	18.07	2,641	1.62
T. 39	" "	11,000	64.4	1.0770	18.6	16.47	0.96	1.17	88.5	88.5	1.774	13.61	1,823	1.44
B. 3859	" "	4,750	64.1	1.0726	17.6	14.27	1.49	1.84	81.1	81.1	1.531	15.02	2,011	1.37

* The figures given in these columns were obtained from the Manager of the St. Augustine Estate.

TABLE III.—PLANT CANES AND FIRST RATOONS.—FIELDS 7 AND 8.

CANE.	SUCROSE IN JUICE.—TONS PER ACRE.		
	Plant Canes.	1st Ratoons.	Average for 2 years.
Badilla	5.07	2.79	3.93
B. 7169... ..	4.32	2.62	3.47
T. 75... ..	4.14	2.38	3.27
B. 6835... ..	4.39	2.06	3.22
D. 116... ..	3.81	2.23	3.02
D. 109... ..	3.44	2.25	2.84
B. 376... ..	3.58	2.03	2.80
R. 3922... ..	2.97	2.51	2.74
B. 208... ..	3.07	2.38	2.72
B. 3412... ..	3.49	1.83	2.66
D. 115... ..	3.42	1.89	2.65
B. 6450... ..	3.14	1.94	2.54
B. 4578... ..	3.32	1.62	2.47
Bourbon	3.13	1.62	2.37
B. 3390	2.77	1.76	2.26
T. 202... ..	2.09	2.42	2.25
B. 16832... ..	2.50	1.92	2.21
B. 3859... ..	2.55	1.37	1.96
T. 39... ..	2.36	1.44	1.90

The results from the second ratoons in Field 5 and from the experiment plots are recorded in Table IV, whereas Table V shows the results obtained from these same canes as plants, first and second ratoons. The average results for the three years are also recorded in this table and it will be seen that, with the exception of D. 4805, all the other varieties have given better results than the Bourbon.

TABLE IV.—SECOND RATONS.—FIELD 5 AND EXPERIMENT PLOTS ST. AUGUSTINE ESTATE.

Cane.	Date planted.	Area under cultivation.	JUICE.						YIELD PER ACRE.			Remarks.		
			Per cent. extracted.	Specific gravity.	Brix.	Percentage.		Quotient of purity.	Lb.	Tons.	Galls.		Tons.	
						Sucrose.	Glucose.							
														Non-sugar.
B. 1753	December, 1911	8,000	63.9	1.0695	16.9	13.98	1.64	1.28	82.7	1,495	36.60	4,898	3.27	Experiment plots.
B. 268	"	8,000	66.4	1.0792	19.1	17.16	0.97	0.97	89.8	1,852	28.16	3,881	3.21	"
B. 376	"	8,000	65.8	1.0722	17.5	15.83	0.79	0.88	90.4	1,697	24.84	3,415	2.59	"
Padilla	November, 1911	46,282	63.2	1.0886	21.4	18.90	1.28	1.02	89.6	2,037	21.01	2,732	2.51	Field 5.
D. 2468	"	41,110	65.5	1.0695	16.9	13.58	2.05	1.27	80.3	1,452	23.59	3,236	2.10	"
D. 504	"	19,602	62.3	1.0744	18.0	15.27	1.92	0.81	84.8	1,641	19.72	2,561	1.88	"
D. 145	"	42,199	64.1	1.0704	17.1	14.79	1.77	0.54	86.5	1,583	17.60	2,361	1.67	"
B. 147	December, 1911	8,000	66.2	1.0700	17.0	14.46	1.53	1.01	85.0	1,547	17.08	2,367	1.63	Experiment plots.
T. 75	"	8,000	59.9	1.0749	18.1	15.46	1.39	1.25	85.4	1,662	17.49	2,183	1.62	"
D. 366	November, 1911	45,738	66.2	1.0723	17.5	14.82	1.70	0.98	84.7	1,589	16.26	2,249	1.59	Field 5.
D. 3866	"	41,664	64.3	1.0726	17.6	14.04	2.55	1.01	79.8	1,506	16.87	2,265	1.52	"
Bourbon	"	40,837	68.3	1.0713	17.3	14.98	1.70	0.62	86.6	1,605	13.73	1,961	1.40	"
D. 4397	"	41,382	62.4	1.0634	15.5	11.73	2.73	1.04	75.7	1,247	18.81	2,472	1.38	"
D. 4905	"	40,837	60.2	1.0617	15.1	11.40	2.50	1.20	75.5	1,210	14.20	1,803	0.97	"

* The figures given in these columns for Field 5, were obtained from the Manager of St. Augustine estate.

TABLE V.—PLANT CANES, FIRST AND SECOND RATOONS FIELD 5 AND EXPERIMENT PLOTS.

CANES.	SUCROSE IN JUICE—TONS PER ACRE.			
	Plant Canes.	1st Ratoons.	2nd Ratoons.	Average for 3 years.
B. 208 ...	4.28	3.62	3.21	3.70
D. 504 ...	3.77	5.18	1.88	3.61
B. 1753 ...	3.81	3.23	3.27	3.44
Badilla ...	3.84	3.70	2.51	3.35
B. 376 ...	4.07	2.83	2.59	3.16
D. 2468 ...	3.55	3.71	2.10	3.12
T. 75 ...	4.40	2.45	1.62	2.82
D. 145 ..	3.60	2.59	1.67	2.82
B. 147 ...	2.69	3.31	1.63	2.54
D. 4397 ...	3.26	2.92	1.38	2.52
B. 3956 ...	2.90	2.63	1.52	2.35
D. 366 ...	2.38	3.02	1.59	2.33
Bourbon ...	2.53	2.82	1.40	2.25
D. 4805 ...	1.80	1.77	0.97	1.51

Government Purchase of West Indian Sugar, 1914—During 1914 the British Government purchased about 900,000 tons of sugar. Demerara and the West Indies benefitted to the small extent indicated in the following table taken from *The Grocer* for May 15, 1915 :—

Date.	Country of Origin.	Quantity (tons.)	Price.	Conditions.
August 12, 1914 ...	Antigua ...	320	20s. 0d.	f. l.
August 20, 1914 ...	Demerara ...	25,000	18s. 6d.	c. & f.
August 21, 1914 ...	Trinidad ...	3,000	17s. 0d.	f.o.b.
August 25, 1914 ...	Demerara ...	20,000	17s. 0d.	f.o.b.

CACAO.

SPECIAL PRIZE COMPETITION.

THE following is the report of the Judges in the Special Cacao Prize Competition 1914-15. The prizes were presented to the winners at the June meeting of the Board of Agriculture by His Excellency the Governor:—

The Director of Agriculture.

Sir,—We have the honour to report that we commenced judging in the Special Cacao Prize Competition on Tuesday, April 6, and finished on Thursday, April 22. During this period we visited competitors in the Wards of Chaguaramas, Oarenage, Diego Martin, Maraval, Santa Cruz, Turure, Upper Oaroni, Manzanilla, Savana Grande, Montserrat and Chaguanas.

There were originally 34 competitors in this competition, 16 in Class I and 18 in Class II, but three in the former and four in the latter withdrew, leaving a total of 27 competitors whose cultivations were inspected and judged.

After very careful inspection of the work of these competitors we feel ourselves fully justified in recommending that all the prizes be awarded as follows:—

Order.	Value of Prize.	Names.	Marks.	Nationality.	Acreage.	District.	Ward.
<i>Class I Pleasant Proprietors.</i>							
1st	Medal & \$20...	Lallsingh ...	86	East Indian ...	9	Petit Valley	D'go Martin.
2nd	„ & \$10...	Cleto M. Hospedales	84	Spanish Trinidadian ...	15	Brasso Tamana	Montserrat.
<i>Class II Contractors.</i>							
1st	Medal & \$10...	Edward Ford..	94	Barbadian ...	3	Brasso Piedra	Montserrat.
2nd	„ „ \$ 5...	Sunarie ...	90	East Indian ...	3	Greenhill ..	D'go Martin.

We considered it our duty, as this is a competition amongst previous prize winners, to scrutinize the work very keenly and in consequence have penalized faults more severely than in the ordinary competition; it is therefore encouraging to note that the average percentage of marks gained in this competition is higher than in the last ordinary competition, and this is especially so with regard to the prize winners who exceed the previous prize winners average by 7·4 in Class I and by 2·7 in Class II.

The results of this competition have fully confirmed us in the opinion frequently expressed, that these competitions are succeeding admirably in stimulating interest in improved methods of cultivation amongst small proprietors and contractors; we feel that the marks obtained in tillage, and especially in draining, warrant the assertion that the value of this class of work is now fully realized. We must however confess to some

slight disappointment as regards sanitation work, the marks for which vary considerably, but it may be stated that remedial measures have generally been well carried out, the loss of marks occurring under the sub-head "preventive." With very few exceptions the "general" work of these competitors is excellent.

It is with very keen gratification that we are able to place on record the appreciation expressed by several owners of large estates, of the benefits they have derived from the competition amongst contractors. Several instances have come to our notice. One owner informed us that after taking over the contract from a former prize winner he has had nothing to do to it except cleaning, and he now gives his ex-contractor continuous employment in sanitation work on his estate. Another admitted having learnt much by observing his contractor work. A third, by actually imitating the work of his contractor in his adjoining field, gave the best possible proof of his appreciation.

The statement volunteered by many of the competing Peasant Proprietors that their crops have materially increased since their entry into the competition, shows that the feeling is becoming general that improved methods of cultivation pay well, if not at once, in the immediate future.

(Sgd.) { F. T. FARFAN.
 { L. A. BRUNTON.

Gold Coast Cacao, 1914.—The export of cacao from the Gold Coast, British West Africa, in 1914 amounted to 52,888 tons, an increase of 2,334 tons over that of the preceding year. The extraordinary development which has taken place recently will be recognized by noting that in 1904, the export was only 5,687 tons. The Gold Coast is now, for quantity, easily the premier cacao producing country. In 1904 this position was occupied by Ecuador with a production of 28,433 tons. In 1914 the Ecuador export had increased to about 41,166 tons, according to a note in *Commerce Reports* published by the United States Department of Commerce.

The increase in the Trinidad and Tobago export during the same period has been from 18,574 tons to 28,325 tons.

Cacao in War Time.—"Robert Pohl, proprietor of the Hamburg export and import firm, Robert Pohl & Co., has been arrested on a charge of swindling in cacao. The firm bought large quantities of cacao-shells in Germany and in Holland, ground them and mixed them with a little cacao of good quality and sold the mixture as cacao which was particularly recommended as "Liebesgaben" (love gift) for the army. No less than 500,000 blocks of this adulterated cacao were seized in the manufactory."—(*The Grocer*, May 29, 1915).

RUBBER.

HEVEA RUBBER CULTIVATION AND CURING AT NON-PAREIL ESTATE, SANGRE GRANDE, TRINIDAD.

The following valuable record of the actual cost of Para rubber collection and curing in Trinidad has been kindly contributed by Mr. E. A. Robinson, the owner of Non Pareil Estate :—

In the year 1914 we started on June 22, on this estate to tap 1,200 trees from 6 years to 9 years old. The older of these trees had been tapped for two years before this. The time for rubber-tapping in Trinidad is from June to the middle of February. During the dry season it is both unwise and useless to attempt to tap.

A return is appended showing the number of days on which we tapped in each month, the number of days' work paid for, the amount of rubber obtained, and the cost of tapping.

It will be found from this, that we tapped during the season on 186 days in all giving 551 days' work. This at 40 cents per day equals \$220.40.

We obtained 1,608 lb. of rubber, which works out at \$13.7 cents per lb.

I find therefore, that to keep up rubber cultivation to a thoroughly efficient standard, and to pay for curing, tapping, machinery, superintendence, transporting, shipping and selling, the cost of one acre of rubber would be as follows :—

Draining and roundridging. (N.B.—This might be varied with forking every two years) ...	\$ c.
Brushing	6 00
Manuring	2 00
Superintendence	6 00
Machinery, curing, etc....	7 00
Tapping	7 00
Packages	40 41
Transporting	1 00
Extras	15 28
Shipping and selling (N.B.—I have account sales from London which work out, even with war charges, at 5 cents per lb. but I allow 6 cents.)	15 28
Total	\$86 14

The trees on this estate are planted 14ft. by 14ft. giving 220 trees to the acre. As therefore the 1,200 trees gave 1,608 lb. of rubber, 220 trees or one acre gave 294 lb. This sold at 50 cents per lb. equals \$147 per acre.

The cost as I have shown, of cultivation, manufacture and sale of this rubber is \$86 14 cents thus leaving a nett profit of \$60 86 cents (£12 18 7) per acre.

Should any one think that my close planting helps to make this profit large, and that in after time I may have to thin out the trees, and thus reduce the output per acre I can only say that in my opinion, as the trees grow older and I have to thin them out, they will increase their yield per tree; consequently the man tapping will collect more rubber from the

same number of trees and therefore the cost of tapping will be proportionately decreased. It will be seen that the cost of tapping is almost half of the total cost of production and that consequently as the trees grow older, and increase their yield, and decrease in number, the cost of production ought to be considerably reduced.

I should not advise any one to go in for rubber planting in a district where the rainfall is less than 80 inches per annum. The rainfall on this estate averages 110 inches, but in 1914 we had very dry weather and the rainfall was only 75 inches.

The rubber on this estate has suffered very little from disease; out of about 40,000 or 50,000 trees of 3 years old and upwards, we have had only five cases of canker; and up to now we have been singularly free from insect pests.

(Sgd.) E. A. ROBINSON.

TAPPING RESULTS OBTAINED FROM 1,200 HEVEA RUBBER TREES AT NON PAREIL ESTATE.

TAPPED ON ALTERNATE DAYS FROM JUNE 23, 1914, TO FEBRUARY 11, 1915,
BOTH DAYS INCLUSIVE.

From 234 days, tapped 186 days, lost 48 days from causes indicated in the last column of table:—

Months.	No. of days tapped.	No. of days lost.	Rubber made.	Cost of tap- ping.	Remarks and reasons for lost days.
1914.			Lb. oz.	\$ c.	
June 23-28, 30 ...	7	1	31 3	5.60	Began tapping 23rd— Machine broken.
July 1-11, 13-16 ...	15	16	111 14	18.00	Machine broken.
August 3-20, 22-28, 31 ...	26	5	233 1	31.20	Do.
September 1-3, 21-30 ...	13	17	125 5	15.60	Do.
October 1-20, 22-31 ...	30	1	294 12	36.00	Heavy rains.
November 1, 3-28, 30 ...	28	2	204 10	33.60	Do.
December 1, 3-10, 12-24, 26-31 ...	27	4	164 1	32.40	Christmas Day, heavy rains, and finishing old cuts on bark.
1915.					
January 1, 3-5, 7-31 ...	29	2	300 15	34.80	Heavy rains.
February 1-11 ...	11	...	142 3	13.20	Stopped tapping on 11th.
Total	186	48	1,608 0	\$220.40	

Three men employed actually 551 days tapping at 40c., \$220.40.
Rubber made and shipped from 1,200 Hevea Rubber trees, 1,608 pounds.
Rainfall from January 1, to December 31, 1914, 75 inches 19 parts.

(Sgd.) JOS. W. SARGEANT,
Manager, Non Pareil Estate.

May 21, 1915.

PLANT DISEASES AND PESTS.

LOCUSTS OR GRASSHOPPERS.

By F. W. URICH, F.E.S., C.M.Z.S.,

Entomologist to the Board of Agriculture.

SINCE 1918 there have been rumours that locusts were invading Venezuela. They are supposed to have come from Colombia, and occurred in the neighbourhood of Guanta and Valencia. In 1918-1914 Dr. Juan Iturbe of Caracas tried the d'Herelle system of infecting locusts with bacterial disease. In January of this year Mr. W. G. Freeman, the Assistant Director of Agriculture, received a letter from Mr. Robert Henderson at Ciudad Bolivar saying that on the 15th of that month locusts had invaded the town. Mr. Henderson reported that they came flying low making a noise like a waterfall. They came from south-west and flew in a north-easterly direction. Very few alighted on the trees and at dark they were gone. On February 11, Mr. Henderson wrote again saying that another small swarm of locusts had passed over Ciudad Bolivar without doing any damage. On May 26, the Government was notified by Mr. Enrique J. Permy, British Vice-Consul at Guiria, a Venezuelan town on the Gulf of Paria, that four days previously locusts had been seen coming from the west towards the east at the rate of six miles per day. On May 30 the first locusts landed at Chacachacare, a small island belonging to Trinidad, about seven miles distant from Venezuela, a few also reached Monos another island between Chacachacare and Trinidad, and on June 4 a solitary specimen was captured alive at Port-of-Spain.

IDENTIFICATION OF THE LOCUST.

Mr. Henderson was good enough to send some specimens of the locusts from Ciudad Bolivar, which were identified by Mr. J. A. G. Rehn of the Academy of Natural Sciences of Philadelphia as *Schistocerca paranensis*, Burmeister. In sending the determination, Mr. Rehn wrote as follows:—"They are of considerable interest, representing as they do the very destructive migratory locust of southern South America. We have a very extensive series of this species from a number of Argentine localities, and your specimens are identical. We also have some specimens, previously undetermined, from Ciudad Bolivar, taken by Carriker, so it seems to be at least more than accidental in its migrations in that direction. It is a very destructive species, equalling any of the Old World in its ravages, and I trust you will have no visitations of it in Trinidad. It is quite close to the well-known *S. peregrina*, the Old World representative of this otherwise American genus. The latter species has also been reported from America, but I am sceptical of these records, as Old World material differs in pronotal characters."

Specimens collected at Guiria and Cristobal Colon (Venezuela) by Mr. Freeman and those taken in Trinidad belong to the same species.

FOOD PLANTS.

On the instructions of His Excellency the Governor, Mr. Freeman with Mr. A. E. Collens visited Venezuela between May 29 and June 1 to obtain information as to the species of locust and the plants it attacked, etc.*

* A report on this visit will be published when the necessary blocks to illustrate it have been made. For localities mentioned see map facing p. 128.

He reports that the following plants were attacked:—*Cassia occidentalis*, banana leaves, *Erythrina umbrosa* (Anauca Immortell), coconut palms of all sizes, beans, *Acrocomia sclerocarpa* (gru-gru palm), *Oreodoxa oleracea* (cabbage palm), Indian corn, cassava, peas, sugar-cane. Cacao was not touched. At Patos the locusts attacked Indian corn and coconuts.

MIGRATION OF A SWARM TO TRINIDAD AND ITS FATE.

There is no doubt that on May 29 and 30 a fairly large swarm was on its way to Trinidad, but fortunately for us, a north or north-easterly wind kept it away and most of the exhausted insects fell in the sea and were drowned. A few stragglers reached our shores and alighted at Patos, Chacachacare and Monos. On June 2 to 4 large numbers of dead locusts were seen floating on the sea and many were washed ashore; the largest quantity having been found at Cedros and Icacos, at the south-east end of Trinidad. They were in an advanced stage of decay and were so numerous that large heaps were collected and burned.

RECENT OCCURRENCES IN TRINIDAD.

Patos.—This island between Chacachacare and Venezuela, is separated from Venezuela by a channel of the Grand Bocas, three miles in width; it was, therefore, to be expected that the island would be more infested than other parts of the colony. The writer visited this island on June 6 and found that flying locusts arrived on the 29th and 30th in some thousands. They attacked a patch of young Indian corn and completely destroyed it, eating off the plants to the ground. Some coconut palms were also attacked, but not badly damaged. The wild vegetation was not touched. At the time of the visit about a hundred locusts were seen on the open field where the corn had been planted. The soil of this island is not suitable for oviposition by the locusts.

Chacachacare.—Mr. Rorer and myself visited Chacachacare from June 1 to 3. Being seven miles away from the mainland of Venezuela this island was less affected than Patos. The lighthouse keeper reported that on May 29 large numbers of locusts arrived near the lighthouse (the highest point of the island). At the time of our visit there were very few locusts to be seen and cultivated plants on the island had not been touched. The wild plants, with the exception of a few small Compositae, were intact. Like Patos, the soil of Chacachacare is far too hard to induce locusts to oviposit.

Icacos and Cedros.—In former invasions these southern districts were always badly damaged and appeared to harbour the most locusts. Mr. Rorer, who visited the district on June 6, did not find any living locusts, but saw large numbers of dead ones washed up by the sea, and in an advanced stage of decomposition. In some places the dead insects were six inches deep. The soil of Icacos and Cedros being sandy is quite suitable for oviposition, and in the 1885 invasion there was quite a severe infestation by young hoppers.

THE INVASION OF 1885.

(A) MR. KERNAHAN'S OBSERVATIONS.

The last invasion by swarms of locusts took place in 1885. Mr. W. J. L. Kernahan who was then stationed at Icacos and took part in the campaign, has been good enough to supply the following notes:—

Locality of Arrival.—Near Government School House at Icacos.

Arrival of Swarm.—The swarm started coming from the direction of the Spanish Main in the middle of the day, and continued arriving for the whole of the afternoon in the months of May or June, 1885. They came in a continuous flight; the sun was hot and the weather was calm.

Behaviour of the Insects.—On arriving, the locusts appeared exhausted and settled on all the low-growing coconut palms and bushes near the shore. They did not go on the tall coconut trees. They seemed to be resting and did not feed. Next day they flew inland to the Icacos Savannah about one mile from the shore, and started eating low-growing vegetation such as pigeon peas, corn and young coconuts.

Dispersal.—From Icacos they spread over the whole district and reached as far as St. Quintin and Columbia Estates; Constance Estate was also affected.

Oviposition.—The females started to lay a day or two after arrival and continued doing so for some time.

Duration of attack.—From the arrival of the adults to the destruction of the young hoppers, a period of three months elapsed.

Methods of destruction.—Not much attention was paid to the flying insects. The egg capsules were dug up and thrown in boiling water. Large quantities were found.

As soon as the young hoppers hatched they were destroyed, (a) by driving them into trenches of sufficient depth and there burnt by means of kerosene oil (b) hoppers rest during the night and early in the morning, before they were active, they were surrounded by dry coconut fronds sprinkled with kerosene oil and burnt.

Number of swarms.—Only one swarm came to Icacos.

Other Localities Affected.—A little time after the Icacos swarms, Chacachacare and Monos were invaded, but oviposition does not seem to have been successful, owing to the nature of the soil, it being too hard.

Species of Locust.—I have shown Mr. Kernahan a specimen of the locust received from Mr. Henderson, and as far as he remembers it looks very much like the ones he saw at Icacos in 1885.

Cultivation Attacked.—Only low-growing plants of all kinds were attacked, young coconuts were affected, but the insects did not fly on to the tall palms.

(B.) MR. J. A. BULMER'S REPORT.

The late Mr. J. A. Bulmer submitted the following report* with reference to the appearance of locusts at Carenage in the North-west of Trinidad, about eight miles from Port-of-Spain, on November 28, 1885:—

In compliance with His Excellency's instructions I yesterday proceeded together with Mr. Johnstone, Assistant Warden of Diego Martin, to Carenage for the purpose of ascertaining how far the reports were correct as to the damage which is being done to crops in that district by the locusts.

* Council Paper No. 83 of 1885.

The locality in which the locusts were found yesterday is about two miles beyond Carenage and it was ascertained from the peasants that the locusts had only made their appearance at this point early yesterday (Friday) morning, having moved up in an easterly direction from cultivated land a short distance beyond on which they had settled the previous day.

A sharp shower of rain fell just before we landed and had it not been that a Ward Constable brought off information as to the position inland of the locusts we should not at that time have suspected that any were near. Not a locust was visible from the vessel.

At a distance of about a quarter of a mile from the shore we came to a small patch of Indian corn and as by this time the shower had passed and the sun was shining small numbers of locusts were seen flying overhead. In the corn patch however we came upon the main body settled on the stalks of the corn and on the ground, it was soon evident that the locusts were not there for the purpose of destroying the corn, although, as existence was necessary to them for about six weeks longer, until they had made their family arrangements for preventing the species from becoming extinct, they had nibbled small portions out of the leaves of the corn, and had, I understood from the owners, so mutilated the plants that they would not be any good afterwards. The locusts had also eaten the wild spinage, but I could find no trace of any damage to cacao or coconut trees nor in fact to anything except the Indian corn and wild spinage.

Selecting the best spot for observing the extent of the swarm of locusts I found that it was confined to a piece of ground about one mile in length along the shore and a quarter of a mile in depth, the ground rising very gradually from the shore and enclosed by high hills covered with trees. Not a bare spot visible on which the locusts would be likely to settle except the small cultivated clearings.

A few straggling locusts came to land from a south-westerly direction and the residents stated that the first arrivals had come from that direction also.

Later in the day the swarm got into motion again and moved off east in a steady stream but appeared to wheel round again on coming to the hills and to keep circling round. With good binoculars I could not observe a single locust go beyond the eastern boundary of the amphitheatre enclosed by the hills, and it was evident from their restlessness that they had an intention of moving off to another place in search of what I trust they will not find in Trinidad a suitable breeding ground.

As the existence of a locust is limited to about three months and a more than half that period is confined to the crawling and hopping stage I conclude from that and certain signs observed yesterday that those now in the island are at least two months old and in the absence of information from any part of the island that young locusts in the crawling or hopping stage have been observed; it is fair to assume that these were not bred in the island. The destruction caused by locusts before they can fly is so enormous that the fact of their presence in a country cannot be overlooked, the hatching grounds are selected of so barren a character that the young progeny must move off as quickly as possible in search of food and clearing every green thing before them, they leave very evident traces of their route.

I am not acquainted with the nature of the ground at Patos but from the extent of that Island, if the ground be favourable, there were not more locusts seen yesterday than might have been bred there, and I think it should be ascertained as quickly as possible by observation at Patos whether there are any traces of locusts there or if any are observed to pass there from the mainland.

The greatest possible distance which a locust can fly has never been decided, but it is known not to be so much as forty miles. That is the nearest distance to the mainland from Cyprus (the Caramanian Coast) and locusts have never reached Cyprus from the mainland. It is quite probable however that they could accomplish the distance between the mainland of Venezuela, and Patos, if favoured by a strong wind.

The peasants on the coast beyond Carenage are making feeble efforts to drive away the locusts from the cultivated patches by beating tin pans, etc., but will not attempt to kill them, they say "God sent them and if we kill them He will send a worse plague upon us."

As to the means for destroying the locusts in the present stage of their existence there are none which would prove really effective, when once they can fly the time for making any impression on their numbers has passed.

If it be proved that locusts can cross from the mainland to Patos and that the nature of the ground there is favourable for depositing the eggs that island should be the place where the young locusts should be killed whilst in the crawling-stage.

In none of my journeys in Trinidad have I noticed any suitable ground for breeding locusts, and whatever may be done to the crops of this country will not in my opinion be done by locusts bred in the island.

I forward herewith a few locusts obtained yesterday, they are somewhat larger and of a lighter colour than those found in the East.

DANGERS OF A SWARM.

A swarm of locusts consists of winged insects of both sexes. When they arrive in a new locality they feed voraciously, and then copulate. Shortly afterwards the females start ovipositing in the ground; as a rule they choose a loose, friable soil for this purpose. We would therefore have to face two attacks if the winged insects are not dealt with effectively. The second attack would follow about three months or longer after the arrival of the winged stages, and would consist of hoppers unable to fly.

LIFE HISTORY IN GENERAL.

The life history of *Schistocerca paranensis* has not yet been worked out but in a general way the eggs would hatch in three months or longer according to the moisture prevalent at the time.

The young hoppers would take three months, more or less, to complete their development and attain the winged stage. As soon as the adult stage is reached copulation takes place, and the adults would migrate to new fields. They would probably live for two or three months, during which time eggs would be deposited. It is possible that there is only one brood a year but this depends entirely on atmospheric conditions.

wet weather favouring the development of the eggs and dry weather retarding it and if prolonged, destroying the eggs.

HABITS OF ADULTS.

As far as observed in the few live insects encountered, the adults are active during the hours of sunshine, they do not like shade, and in consequence are generally found in sunny, open spots such as corn fields. They are very wary and take to flight quickly on the approach of any one. In flying, they rise from the ground, circle high in the air and then steer a course to vegetation away from the seat of disturbance. The insects arriving from Venezuela at Chacachacare appeared to be descending from a considerable height and most of them alighted on the highest point of the island, about 900 feet.

ARTIFICIAL CONTROL.

The best way of dealing with locusts is to poison them by spraying their food plants with mixtures containing arsenic or putting out poisoned baits.

FORMULÆ.

(1.) *Arsenate of Lead Spray.*

Arsenate of lead paste	...	...	4 lb.
Water	...	...	50 gallons.

It is advantageous to slake 4 lb. of stone lime in the 50 gallons water.

(2.) *Arsenite of Soda Spray (Simpson's formula).*

Stock Solution.

White arsenic	...	...	1 lb.
Washing soda	...	...	4 lb.
Water	...	...	1 gallon.

All ingredients are boiled together for a few minutes or until dissolved, and any water lost by evaporation added. For use slake 2 or 3 lb. of stone lime in 50 gallons water to which add 1 pint of stock solution and 1 gallon molasses.

(3.) *Bran Mash (Hunter & Claasen's formula).*

I. Paris green or white arsenic	...	...	2½ lb.
Bran	...	...	50 lb.

Mix these dry.

II. Sour oranges or limes chopped up fine, rind and all					6
Molasses	...	...	...	...	4 quarts.
Water	...	...	...	...	5 gallons.

Mix these three together thoroughly.

Mix I and II, then add sufficient water to make a wet mash.

CAUTION.—Do not add the water to make up the mash until the day the poison is to be distributed.

Early in the morning this poisoned bran should be scattered broadcast in the infested areas. It is of great importance to get the poison out early so that it may not dry up too quickly.

In the Laboratory the bran mash has been very successful in disposing of adults which ate it readily. The mash was made up in accordance with above formula but the oranges or limes were left out. Besides the mash, the cage was supplied with green food consisting of coconut and banana leaves. The mash was put in on June 5, at about 9 a.m. It had not been long in the cage before the insects went to it and ate, the next day at 8 a.m. when Mr. Rorer examined the cage, nine of the sixteen individuals put in were lying in the bottom of the cage dead or practically so, merely moving an antenna or leg; all the others looked very sick and did not attempt to fly or hop when the door of the cage was opened. By the 8th all had died, whereas insects kept apart as a check and fed with the same green food were in good health.

LOCUST DESTRUCTION IN SOUTH AFRICA.

Through the kindness of His Excellency the British Minister at Caracas and with the permission of His Excellency the Governor, the following memo. of Mr. Cecil Elmy on locust destruction in South Africa is added.

The following is a brief description of the method of locust destruction that has been taken up by the Union Government of South Africa, and which has proved to be the only successful, and at the same time the most economical way of fighting this plague.

Locust destruction operations are taken in hand as soon after the insects are hatched out as possible, and continue throughout the "hopper" or "voetganger" stage until the locusts are on the wing. This represents a period of about two months to three.

A poison spray is utilized, the ingredients of which are:—

1. 2 lb. of arsenic, 1 lb. if the insects are being dealt with in the very early stage, 2 lb. from the fifth week on.
2. 4 lb. caustic soda
8 lb. coarse sugar, or molasses.

The soda is only required in order that the arsenic may be quickly dissolved in cold water, so as to do away with the necessity of boiling.

In South Africa the Government obtains what is known as Arsenite of soda from the States, this comes over in 2 lb. tins costs under 6d. a tin, and can be dissolved in cold water. It consists of arsenic and soda in the proportions indicated above.

The ingredients are dissolved in two gallons of water, after which a further 14 gallons are added, when the mixture is ready for use.

Hand spray pumps which can be attached to any ordinary bucket are the ones generally utilised, and cost about 15/- each.

As is known, young locusts always keep together in "herds" or clumps, in the early mornings and in the evenings they are found in "close swarms" formation. In South Africa old Native women, little boys and girls are used for "driving" locusts out of any cultivated grounds, and in joining any adjacent "herds" together by means of beating the grass with twigs, etc., and prevent these "herds" dispersing whilst being sprayed. Where various such herds may have been driven

together and cover a fair area of ground, it is as well if two sprayers are utilised at the same time working from opposite sides. In the first instance all vegetation, bush, grass, etc., are sprayed NOT SOAKED, FAIRLY SATURATED; after which the spray is generally played over the "herd." Even should numbers of locusts break away it will be found that they are attracted back by the smell of the sugar. Provided that rain does not fall shortly after spraying operations, (in which case the spraying operation would have to be repeated, as the poison naturally becomes diluted), the ground can be visited six hours after spraying, when it will be found smothered with a mass of dead locusts.

The vegetation sprayed, withers, the roots however, are not affected, and bush and grasses etc., soon recover. Cattle, horses, goats, etc., can be allowed to graze on ground so sprayed without any fear of their suffering; on the contrary, they will benefit. The only mortality in South Africa occurred in the case of poultry gorging themselves with poisoned locusts, and also where locust officers have possibly been negligent and natives have been able to acquire some of the arsenic in the dry form, in such instances the older and uglier wives of the locality have died off in a rather startling manner.

In Natal and Zululand the District police keep the Agricultural Dépôt advised of the movements of flying swarms of locusts, and of the localities where eggs have been deposited. They further advise the appearance of locusts hatched out.

The natives on locations have to render free service in connection with carrying water, driving locusts, etc. Farmers have to kill off all young locusts on their land, if unwilling to do so the Government undertakes the work and charges the farmers with all expenses incurred. The poison is supplied by the Government at cost price.

On Crown Lands and Native locations the Government carried out the work.

One man with a spray can get through 60 herds of locusts easily in a day, and it is surprising how rapidly even badly infested districts can be cleared.

Prior to the adoption of these means the Government frequently had to spend many thousands of pounds in supplying the Zulus with maize on account of the destruction of their crops by locusts, to-day the crops are always saved, the cost of locust operations in Zululand varying from £1,000 to £2,000.

Should any further information be desired I shall be pleased to furnish same. I may mention that I acted as Assistant Chief Locust Officer in Natal, and assisted in the general organising of the work sketched out in this memo.

(Sgd.)

CECIL ELMY.

Caracas,
June 29, 1915.

LATEST REPORT FROM VENEZUELA.

According to a letter dated June 25 received from the British Vice-Consul at Guiria (Mr. Permuy) the flying insects have disappeared and their place has been taken by swarms of young hoppers which are at Guiria in the savannah, and in the districts of Guarama and Guaraguara six miles away. A swarm of flying locusts was reported to be near the town of Yaguaraparo 60 miles from Guiria.

THE SITUATION IN TRINIDAD.

Nothing much has been heard of the few insects that arrived here at the commencement of June, and the likelihood is that they have been disposed of by some of our insect-eating birds. As long as locusts are developing in Venezuela, the menace of an invasion remains, and we must be on the lookout for swarms as soon as the young hoppers complete their development.

A DISEASE OF IMMORTEL TREES.

At the March Meeting of the Board of Agriculture, I reported on a disease of immortal trees which has often been reported from the district between Sangre Grande, Mitan, Biche and Tamana.

The bucare (*Erythrina velutina*) is the variety generally affected. The leaves show the first signs of trouble; they turn a pale green colour, and later become yellow. Then follows a general dying back of the trees from the extremities, the dead branches falling off one by one till the trunk alone is left standing. This soon rots and falls to the ground.

When the very first symptoms of the disease are seen, namely, the unhealthy greenness of some of the leaves, sections of the bark show that the trouble is far advanced. The greater part of the inner bark is off colour and dark red streaks are met with. When the disease is well under way, all the bark tissues become discoloured and emit an offensive odour. Often, though not always, the cacao trees under the dying immortal trees show similar symptoms, namely, yellowing of the leaves and dying back of the young branches, and it is commonly believed that the disease is communicated from the one to the other.

The trees do not die singly, but in groups of from ten to twenty or more, the affected areas being widely scattered. The trouble nearly always occurs in contracts from four to eight years old, or in contracts recently taken over, where there are no drains at all or only one foot drains, or in older cacao which is not, or has not been sufficiently drained.

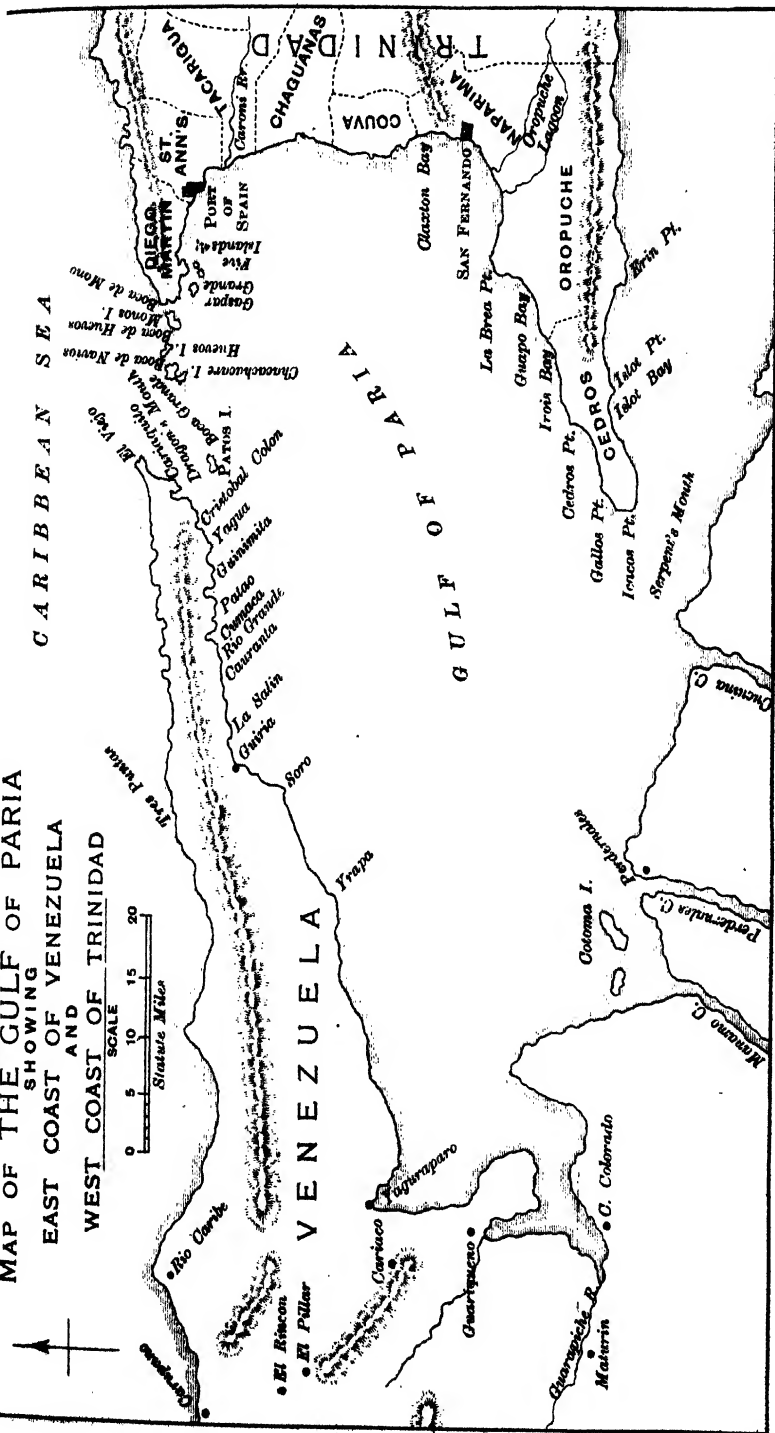
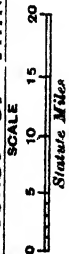
Material from diseased trees, both immortal and cacao, has been examined upon several occasions, but no parasites have been found. In the discoloured bark of the immortal, bacteria are often found, but inoculations from pure cultures have always given negative results.

The general appearance of the trees, the pale green leaves and the gradual dying back beginning with the smallest branches, all suggest root trouble of some kind. A careful examination of the roots and soil was made in several places. In all cases where trees were dying the surface soil was thin and the subsoil was an impervious, very sticky, grey clay. This subsoil was wet and pasty even at the height of the dry season. On very steep hillsides where trees were dying, a very wet subsoil was found at eighteen inches below the surface. The trouble was not met with in adjacent places where the soil was naturally more permeable to a depth of $8\frac{1}{2}$ to 4 feet or where it had been made so by deep drainage. It cannot yet be

CARIBBEAN SEA

CARRIBBEAN SEA

WEST COAST OF TRINIDAD



said definitely whether or not the disease is caused by a parasite, but it is quite evident that the best means of controlling it is by deep and thorough drainage. In fact, in some places the disease has already been checked in this way. That the cacao trees die in the same areas is due to the waterlogged condition of the soil and to the sudden removal of the shade before the trees have grown together.

A further search for parasitic fungi or bacteria will be made.

J. B. RORER.

COCONUT BUD-ROT.

THE following is a summary of a report made at the May meeting of the Board of Agriculture on the work which has been done up to the present time in connection with coconut bud-rot.

The experiments at both Roxborough in Tobago and Toco in Trinidad show that the disease can be prevented from gaining a foothold by frequent spraying with Bordeaux mixture. Coconut palms, the crowns of which are not more than 15 to 18 feet from the ground can be sprayed easily and economically, and it would certainly pay to do so should there be a serious outbreak of bud-rot on the estate. The difficulty of spraying taller trees is however so great that the disease can be combatted most economically by sanitary measures alone, especially if it is not epidemic.

Sanitary and educational work on this disease, especially among small proprietors, was begun in November, 1909 and carried on for over a year. Practically every district of the Colony was visited, and 18,068 dead or dying trees on properties owned by small proprietors were cut down and the infectious parts destroyed. It was not possible in all cases to ascertain whether some of the trees which had been long dead had been killed by bud-rot or by other causes, but it is safe to say that fully 60 per cent. of the deaths was due to bud-rot.

The following table of the number of trees cut down shows that the disease was found in all parts of the Colony:—

Cedros Ward	...	...	...	...	8,741 trees.
Manzanilla, Mayaro and Guayaguayare	...	...	...	...	6,077 „
Laventille	...	...	...	...	1,869 „
Toco	...	...	...	...	1,142 „
Tobago	...	...	...	...	284 „
St. James, Four Roads and Chaguaramas	...	...	...	...	225 „
Blanchisseuse	...	...	...	...	215 „
Tunapuna	...	...	...	...	15 „

18,068

If bud-rot is to be kept under control by sanitary measures there must be no cessation in the destruction of diseased trees. At the first signs of disease the trees must be cut down and the dangerous parts destroyed. The infectious portions are the bases of the leaves, the flower-stalks, the spathes, the strainer and the whole of the soft, upper part of the stem; in fact, all parts of the plant which show the slightest rot or a discoloration of the tissues. All the material must be made innocuous in some way. It may be buried under at least 12 inches of soil, or thoroughly burned. It is not sufficient to gather a few dry leaves, light them and throw the diseased material on the fire. The top of the stem must be split into several sections, so that all the rotted parts will be exposed to the full heat of a good fire.

Although Johnston claims that *Bacillus coli* is the cause of bud-rot, it is possible that other organisms may play a part in the disease, and experiments to determine this are now in progress.

J. B. RORER.

CITRUS CANCKER.

In the latter part of 1912 a new citrus disease, to which the name canker, has been given, was discovered in Florida attacking the leaves and twigs of grape fruit. Since the time of the first discovery, citrus canker has spread very rapidly throughout the orange belt of the southern United States, being found not only in Florida, but also in Alabama, Texas, Louisiana and Mississippi.

The first serious outbreak of the disease was observed in a nursery, and from the evidence at hand it seems probable that the germs of the disease were introduced from Japan on *Citrus trifoliata* stock.

Citrus canker is now considered the most serious of citrus diseases, and the Legislature of Florida has appropriated \$250,000 to be spent on eradication and control work.

The varieties of citrus trees are susceptible to the disease in the following order; grape fruit, *Citrus trifoliata*, lime, navel orange, sweet oranges, Satsuma, mandarin and king orange and lemon. The last four varieties are only very slightly susceptible.

Some idea of the appearance of the disease may be had from the following description taken from one of the bulletins of the Florida Agricultural Experiment Station:—

“The disease spreads as small circular spots, from less than one-sixteenth to one quarter of an inch across. They may occur singly, or several together may form an irregular area. They are raised above the

surrounding tissue, are light brown, and composed of a spongy mass of dead cells covered by a thin (white to greyish) membrane that finally ruptures and turns outward, forming a ragged margin around the spot. The general appearance of the spots is much the same whether they are found on the leaves, fruit or twigs. The older spots often become overgrown with saprophytic fungi, and may be pink or black on account of secondary infection by species of *Fusarium* or *Cladosporium*.

"The infections on the leaves appear first as small watery bulging dots, which are usually of a darker green than the surrounding tissue. They may appear on either surface of the leaf, but do not penetrate through the leaf tissue at this stage. The spots gradually increase in size, change to a light brown colour, and become visible on both sides of the leaf. Each spot is surrounded by a narrow yellowish band or zone. Later, the surface of the spot becomes white to greyish, and finally ruptures exposing a light brown central mass.

"The spots from the surface are similar to those on the leaves. They project from the surface and retain a circular outline. They do not penetrate far into the rind, and may be scattered singly over the surface, or several may occur together, forming irregular masses.

"The spots on the older twigs are more prominent, and usually larger and more irregular in shape. They show the same spongy tissue and the same colour as those on the leaves. On growth more than a year old, the spots assume a cankerous appearance, and the membrane covering the surface disappears. The spots do not penetrate to the wood, but are confined to the outer tissues of the bark."

Although at first the disease was supposed to be caused by a fungus belonging to the genus *Phoma* or *Phyllosticta*, the most recent paper on the subject proves that it is caused by a bacterium. This specific organism, *Pseudomonas citri*, has been isolated from canker spots, and grown in pure culture. Plants inoculated with the pure cultures showed signs of disease after four days. The organism was re-isolated from the inoculated plants.

As yet, no very definite means of combatting this disease have been formulated. Treating infected groves and nursery stock with fungicides or cutting them back and defoliating, have not given satisfactory results. Treatment with fire is considered probably the only efficient means of control. The method adopted consists of burning the trees, grass, and soil beneath the trees with a spray of a flaming mixture of kerosene and crude oil. This is applied with a blow torch, and the plants are quickly burned to cinders. Naturally a rigid inspection of all citrus stock should be made, followed by a strict quarantine of all infected nurseries.

FROGHOPPER CONTROL.

THE following Circular was issued to sugar estates in April:—

FIRST SIGNS OF FROGHOPPER.

Soon after rain commences, no matter how light the showers are, careful search should be made for the first signs of the frog hopper.

Sometimes adults only are seen in cane tops—in some cases these have come from long distances, mostly from abandoned fields, drains, and traces. Scattered nymphs are often hidden away in places where there is enough moisture to hatch eggs that have been aestivating in favourable spots, the adults that issue from these find their way to the cultivated fields.

BEFORE WET SEASON BEGINS.

(1.) Traces are to be hoed and the rubbish taken to the pens.

(2.) All trash should be removed to the pens, and not returned to the fields till well broken up and sodden—especially the trash of the two or three rows of cane nearest traces, or grass land.

ON APPEARANCE OF FROGHOPPERS.

(3.) Although only a few adults may at first be seen, it is important that these should be killed in cane tops by squeezing leaf-sheaths, later when they become numerous, both this method and trap-lights should be resorted to—for the latter, dark rainy nights will yield best results.

(4.) Early broods of nymphs should be destroyed by hand-picking.
(See Bulletin No. 76, Vol. XII, December, 1918, p. 200.)

P. L. GUPPY,
Entomologist in Charge Frog hopper Investigation.

BOTANICAL.

ORCHIDS IN THE ROYAL BOTANIC GARDENS.

Species in Flower, March to June, 1915.

Each month during which a species has been in flower is indicated by a x in the corresponding column.

ORCHID.	M'ch.	April.	May.	June.	REMARKS.
1. <i>Bifrenaria aurantiaca</i> Lindl. ....	...	...	...	..	Trinidad.
2. <i>Bletia alta</i> (L.) Hitch. ...	...	x	...	x	West Indies, etc.
3. <i>Coelogyne</i> sp....	...	x	x	x	
4. <i>Cattleya labiata</i> Lindl. (C. Gigas) var. <i>Sanderiana</i> ...	...	...	x	...	
5. <i>C. Schroederiana</i> Rehb. f.	...	...	x	...	
6. <i>Cyrtopodium cristatum</i> Lindl. ...	x	...	...	...	Trinidad. Terrestrial.
7. <i>Cyrtopera longifolia</i> (Kunth) Rehb. f.	x	...	...	...	" "
8. <i>Catasetum macrocarpum</i> L. C. Rich.	x	x	...	...	Trinidad & Tobago.
9. <i>Diacrium bicornutum</i> (Hook) Benth.	x	...	...	..	" "
10. <i>D. bicornutum</i> (Hook) Benth— var <i>indivisum</i> Cogn.	...	x	...	...	Trinidad.
11. <i>Dendrobium fimbriatum</i> Hook var. <i>oculatum</i> ...	...	...	x	x	x India.
12. <i>D. noschatum</i> Sw. ...	...	...	...	x	x Burma.
13. <i>D. Pierardi</i> Roxb. ...	...	x	...	...	India.
14. <i>D. aggregatum</i> Roxb.	...	x	...	...	Burma.
15. <i>D. sanguinolentum</i> Lindl.	...	...	...	...	x Penang.
16. <i>D. sp.</i> ...	...	...	...	x	x
17. <i>Dichaea graminoides</i> (Sw.) Lindl.	...	...	...	x	x Trinidad & Tobago.
18. <i>Epidendrum fragrans</i> Sw.	...	x	x	x	" "
19. <i>E. atropurpureum</i> Willd.	..	x	...	...	Trinidad.
20. <i>E. patens</i> Sw. ...	..	...	...	x	...
21. <i>E. ciliare</i> L. ...	...	...	...	x	...
22. <i>Epistephium parviflorum</i> Lindl.	...	x	...	...	..
					Terrestrial.

Orchids in Flower, March to June, 1915.—Continued.

ORCHID.	M'ch.	April.	May.	June.	REMARKS.
23. <i>Gongora quinquerivis</i> Ruiz et Pav.	x	x	x	x	Trinidad.
24. <i>Ionopsis utricularioides</i> (Sw.) Lindl.	x	x	x	x	Trinidad & Tobago.
25. <i>Lockhartia acuta</i> (Lindl.) Rehb. f. ...	x	...	...	...	Trinidad.
26. <i>Maxillaria rufescens</i> Lindl.	...	x	x	x	Trinidad & Tobago.
27. <i>Oncidium ampliatum</i> Lindl.	...	x	x	x	Trinidad, <i>Yellow bee</i> .
28. <i>O. guttatum</i> (L.) Rehb. f.	...	x	x	x	Trinidad & Tobago.
29. <i>O. Lanceanum</i> Lindl.	...	x	x	x	Trinidad. <i>Brown bee</i> .
30. <i>O. Papilio</i> Lindl. ...	...	x	x	x	„ <i>Butterfly</i> .
31. <i>O. pusillum</i> (L.) Rehb. f.	..	x	x	x	„ „
32. <i>Ornithocephalus gladiatus</i> Hook	...	x	x	x	Trinidad & Tobago.
33. <i>Paphinia cristata</i> Lindl.	...	...	...	x	Trinidad.
34. <i>Pleurothallis leptopetala</i> Cogn (n. sp.)?	x	x	x	x	„
35. <i>P. pruinosa</i> Lindl. ...	...	x	x	...	Trinidad & Tobago.
36. <i>P. sertularioides</i> (Sw.) Spreng. var. <i>B. trinitensis</i> Griseb....	x	x	...	...	„ „
37. <i>Rodriguezia secunda</i> Kunth	...	x	x	x	„ „
38. <i>Schomburgkia Humboldtii</i> Rehb. f....	x	...	...	...	Venezuela.
39. <i>Scaphyglottis proliфера</i> (R. Br.) Cogn.	x	x	...	...	Trinidad & Tobago.
40. <i>Stelis ophioglossoides</i> (Jacq.) Sw.	...	...	x	x	„ „
41. <i>Stenia pallida</i> ...	...	...	x	x	Trinidad.
42. <i>Stenorrhynchus orchioides</i> (Sw.) L. C. Rich. ...	...	x	x	...	Trinidad & Tobago. Terrestrial.
43. <i>Triseuxis falcata</i> Lindl....	...	x	x	x	Trinidad.
44. <i>Vanda teres</i> Lindl. ...	...	x	x	...	Burma.
45. <i>V. tricolor</i> Lindl. ...	...	x	...	...	Java.
46. <i>Vanilla phaeantha</i> Rehb. f.	...	x	x	...	Trinidad & Tobago.
47. <i>V. Hartii</i> Rolfe ...	...	x	x	...	„ „

NURSERY WORK.

St. Clair Nurseries April to June, 1915.

Plants.

	Sold.	Distributed in exchange or gratis.
Cacao		
Budded	223	—
Selected seedlings	10,888	100 *
Coffee		
Robusta	3,133	16
Other varieties	816	—
Limes	12,189	1
Fruits		
Avocado (budded)	3	—
Mangos (grafted)	77	10
Citrus (budded)	75	—
" (seedlings)	24	—
Miscellaneous	649	19
Spices... ..	226	—
Timber Trees	80	34
Shade "	141	28
Palms	162	57
Ferns	11	1
Flowering Plants (decorative)	465	320
Foliage " "	367	7
Miscellaneous	21	—
Totals	29,000	593

* Calabacillo (to Botanic Station, Tobago).

Seeds.

	Sold.	Distributed in exchange.
British Honduras Mahogany	20,270	—
Immortelle	15,000	—
Woolly Pyrol	—	20 lb.
Robusta Coffee	12½ lb.	—

The receipts for the same period amounted to £151 17 0½.

NEW COLLECTIONS OF NATIVE PLANTS.

DURING the past few months there have been added to the collections of the Gardens numbers of different classes of wild plants which are more especially found in distant, out-lying districts of Trinidad, such as Sangre Grande to Tamana, Caparo, Cedros, Icacos, Chatham, the Irois Forest, and nearer to Port-of-Spain from Maraval, including La Sieva Valley, and St. Ann's Valley. It is proposed to go by degrees through the whole of the island in search of characteristic plants for the purpose of enriching the Government collections, and in due course providing plants for sale. Several rare and extremely interesting orchids, aroids, ferns, grasses, sedges, aquatic and swamp plants are among those already gathered together. As opportunity offers it is proposed to acquire, in a similar way, groups of the Tobago plants, many of which are only as yet found on that island. Each plant is being correctly labelled and is available for inspection, and study to the public, whose growing interest in the work it is pleasing to record. It may be as well to state that these collections are principally kept at the Royal Botanic Gardens in the area near the orchid and fern houses, known in former days as "the Nursery," and in fact still so recognized. This lies at the back of Government House and is easily accessible. Many persons have the idea that this portion of the Gardens can only be seen and entered by special authority. This is no longer the case; it is open to visitors anytime throughout the day that the Gardens are open to the public.

W. E. B.

MESUA FERREA.

The Iron Wood Tree of India and Ceylon.

It would be difficult to imagine a more formal, naturally grown tree than this Indian and Ceylon iron wood, its out-line from base to tip suggesting correct pruning, an operation however, to which it has never been subjected. There is but one specimen in the Royal Botanic Garden and that was planted long ago. It is a handsome tree with large white, single, rose-like, fragrant blossoms, and beautiful blood-red young foliage. In general aspect the tree in question, may be compared in shape and form, to a huge sugar loaf pine-apple. Established in an avenue the effect of these iron woods can perhaps better be imagined than described for beauty, elegance and colouring. The tree is growing to the west of the plant and orchid houses. It may be worth mentioning that the new coloured leaf parts remain fresh for days in a cut form and are thus useful for house and table decoration. So far propagation has only been successfully done by layering, although two or three seeds were secured about two years ago. An importation of seeds has recently been made in the hope of obtaining more plants. In its native country it is of some economic importance, the seeds yielding an oil.

W. E. B.

A New Species of *Achyranthes* from Tobago—In the *Proceedings of the Biological Society of Washington*, Volume XXVIII. pp. 87-8, April, 1915, Mr. Paul C. Standley publishes the description of *Achyranthes Ingramiana* Standley, collected along the sea shore of Little Tobago Island by Mr. W. E. Broadway, in 1914. *Achyranthes* is a generic name for the group of plants usually known as *Alternanthera*, some species of which are frequently employed as low edging plants for the flower beds, their leaves having various shades of red, orange, yellow and pink.

Concerning this new plant Mr. Standley says:—

“Mr. W. E. Broadway, who by his extensive collections has contributed so much to our knowledge of the flora of Trinidad and Tobago recently forwarded to the writer, among other plants, specimens of an undescribed *Achyranthes* from Little Tobago Island. This island, which lies just off the north-east coast of Tobago, was unknown botanically until visited by Mr. Broadway in July, 1914. Interest in Little Tobago has been enhanced recently by the fact that Birds of Paradise have been liberated upon it by the owner, Sir William Ingram, proprietor of the *Illustrated London News*, from whom, at Mr. Broadway's suggestion, the new species of *Achyranthes* is named.”

W. G. F.

LIVE STOCK.

THE ARTIFICIAL FERTILISATION OF MARES.

The Bulletin of Agricultural Intelligence and Plant Diseases, March, 1915, contains the following summary of recent work :—

“ The artificial fertilisation of mares, although for a long time the object of research, has only lately attained practical importance through the work of Dr. Ivanhoff, the Chief of the Physiological Department of the Veterinary Service in Petrograd. This investigator fertilised no less than 579 mares with natural spermatozoa between 1899-1910, and obtained excellent results. Most of the offspring of these mares have proved useful animals; the results from a stud of Russian trotters have even been successful on the race course and remounts and draught animals have also done well.

“ Ivanhoff's method has the advantage of not injuring the reproductive organs and is easy to carry out. It has also been adopted with much success at the Hungarian State Stud, Kisber, by Dr. Treisz. The latter, however, used somewhat differently constructed instruments in his experiments and only disinfected them in boiling water. Further the spermatoc fluid was not diluted with milk but injected pure directly into the uterus, 5 cc being used at a time while Ivanhoff prescribed 10 cc. The results obtained at Kisber showed that 5 cc should be amply sufficient to fertilise one animal.

“ So far the experiments in Hungary have been carried out on 5 half blood mares, while Treisz fertilised with the spermatoc fluid of an English imported thoroughbred. The mares which were always kept separate from the stallion gave birth a short time ago to 5 completely healthy foals. As the experiments have proved so successful in Hungary, they will be continued.”

AGRICULTURAL EDUCATION.

AGRICULTURAL PUPIL EXAMINATION, 1915.

THE examination for six places as Agricultural Pupils in accordance with the announcement (*Bulletin, Department of Agriculture XIV. p. 68*) has been held. There were eighty-four candidates of whom seventy-six sat for the examination which was held in three centres, Port-of-Spain, San Fernando and Tobago.

The successful candidates, whose names are given below, took up work at River Estate, on July 1:

1st	Louis J. Williams, Naparima College...	...	115
2nd	Lionel T. Rostant, St. Mary's College..	...	113
3rd	Gabriel Pierre, Tunapuna Government School	...	105
4th	Samuel T. Cupid, St. Joseph Government School...		103
5th	Egbert Hoyte, Arouca Government School	...	98
	Percy A. Mayers, Diego Martin R. C. School	...	98

The possible number of marks was 120.

The following was the examination paper:—

DEPARTMENT OF AGRICULTURE — AGRICULTURAL PUPIL SCHEME EXAMINATION, 1915.

TIME ALLOWED 1½ HOURS.

Each candidate must put his number only, not his name, on the top of each sheet used for answering the questions.

A.—DICTATION.

B.—ARITHMETIC.

1. How many trees would there be to the acre planted,

(1.) 12 feet by 12 feet.

(2.) 15 feet by 15 feet.

2. When cacao is selling at \$15.50 per fanega, what is it worth in pounds, shilling and pence per bag of 165 lb.

3. Make out a bill for the following articles:—

250 lb. of Stock feed at \$1 80 per 100 lb.

75 lb. of Onions at 5½c. per lb.

80 lb. of Tannias at 2½c. per lb.

800 lb. of Oil meal at \$2 55 per 100 lb.

What would the amount be if 4 per cent. discount were deducted.

4.—A school consists of two buildings 30 feet by 12 feet, and 40 feet by 15 feet respectively, standing on a plot of land 120 feet by 80 feet. What is the area in square yards of the land *unoccupied* by the buildings?

C.—AGRICULTURAL KNOWLEDGE.

Write a letter as to a friend describing a visit to a cacao or sugar estate during crop.

METEOROLOGY. RAINFALL RETURN FOR MARCH TO JUNE, 1915.

STATIONS.	1915.				1914.				1915. June. to June.	1914. June. to June.
	March.	April.	May.	June.	March.	April.	May.	June.		
	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.		
<i>North West District.</i>										
St. Clair—Royal Botanic Gardens	Nil	2·63	2·76	7·05	1·28	1·01	2·05	7·34	Ins.	Ins.
Port of Spain—Colonial Hospital	Nil	1·46	5·89	6·29	0·05	1·45	1·49	6·58	15·20	12·79
" " Royal Gaol	Nil	1·97	3·44	5·89	0·07	1·37	1·89	6·20	11·51	11·03
" " Constabulary Head-quarters	Nil	2·25	4·92	4·37	0·02	1·26	2·64	6·51	14·13	11·35
St. Ann's—Reservoir	Nil	2·23	3·07	8·29	0·83	1·05	1·78	6·51	12·64	12·60
Maraval—Reservoir	Nil	3·51	4·03	9·78	1·93	1·38	2·08	6·88	12·21	12·21
" " Constabulary Station	Nil	5·15	4·55	11·29	1·38	1·87	2·76	6·85	20·49	14·39
Diego Martin	Nil	4·35	6·56	10·31	1·33	1·32	3·96	7·53	23·45	15·21
" " Waterworks	0·12	4·36	5·72	6·26	1·30	1·47	3·62	6·33	24·14	14·65
" " River Estate	0·04	4·34	6·01	7·59	1·18	1·66	3·85	6·88	19·49	13·94
Fort George Signal Station	Nil	1·93	3·24	8·29	2·21	1·53	2·66	6·88	19·86	14·11
North Post	Nil	3·11	5·76	4·87	0·94	0·66	2·72	6·88	16·13	11·59
Carenage Constabulary Station	Nil	2·38	6·64	10·53	2·70	0·74	5·11	10·42	15·19	11·59
Carrera Island Convict Depot	0·02	1·11	4·63	4·24	0·24	0·54	2·22	7·34	22·07	20·68
Chacachacare Light House	0·06	3·03	5·58	7·22	0·98	0·98	4·25	6·03	11·96	11·96
<i>Santa Cruz—Maracas District.</i>										
Santa Cruz Constabulary Station	Nil	3·83	5·23	8·87	1·33	0·89	2·12	8·56	20·53	15·09
St. Joseph, Government Farm	Nil	3·60	5·08	7·27	0·31	3·38	1·57	7·12	18·08	14·85
St. Joseph, Constabulary Station	Nil	3·85	2·91	4·47	0·10	3·01	1·24	6·53	13·65	13·02
Tunapuna, St. Augustine Estate	Nil	5·66	4·10	7·51	0·15	3·50	1·41	6·24	19·84	14·22
Maracas—Government School	Nil	3·44	3·69	6·84	1·05	0·95	2·74	8·61	16·92	15·82
" " Orinola Estate	0·14	3·73	3·18	9·23	0·86	1·08	2·35	7·61	19·89	16·24
Caura, Wardour Estate	0·08	2·83	2·80	7·00	0·69	2·00	1·90	7·07	14·97	14·26
<i>West Central District.</i>										
Caura, Frederick Estate	0·02	8·12	4·03	10·61	1·90	3·77	4·48	20·64	25·75	39·87
Chaguanas, Constabulary Station	0·25	3·11	5·34	8·36	0·45	0·90	2·31	9·75	20·10	16·65
Chaguanas, Woodford Lodge Estate	0·15	3·02	5·38	8·62	0·34	0·69	2·82	9·39	20·37	17·21
Carapichaima, Waterloo Estate	0·03	2·20	4·27	6·68	0·45	1·83	3·46	8·04	16·72	16·70
" " Friendship Hall Estate.	Nil	2·35	4·66	7·39	0·57	1·46	4·40	8·55	19·40	18·67

RAINFALL RETURN FOR MARCH TO JUNE 1915.—CONTINUED.

STATIONS.	1915.				1914.			1915.	1914.
	March.	April.	May.	June.	March.	April.	May.	June.	June.
<i>West Central District.—Contd.</i>									
Couva, Exchange Estate	Ins.	2.58	3.09	6.95	Ins.	0.85	1.87	6.91	Ins.
" Brechin Castle	Nil.	1.95	4.22	8.86	0.23	1.55	2.10	18.24	11.31
" Perseverance	0.09	2.01	3.30	5.51	0.26	1.11	3.34	19.92	15.01
" Camden	0.10	2.31	3.54	7.92	0.39	0.86	1.77	15.20	16.32
" Milton	0.22	2.11	3.97	10.75	0.15	1.59	1.16	18.35	11.89
" Spring	0.11	1.72	5.50	10.10	Nil.	0.94	1.53	23.14	14.23
" Constabulary Station	0.06	2.06	2.30	7.78	0.42	1.33	2.89	22.97	15.39
" Esperanza Estate, Savonetta	0.05	2.21	4.16	8.91	Nil.	1.70	2.03	17.60	15.32
<i>Montserrat District.</i>									
Brasso, La Vega Estate	0.15	2.85	7.54	14.13	0.32	0.77	2.87	31.41	21.49
Montserrat, Constabulary Station	0.16	2.42	5.25	11.43	0.46	1.78	1.92	24.83	16.63
<i>Arima District.</i>									
Arima, Warden's Office	Nil.	3.05	5.85	8.68	0.18	0.22	2.59	19.70	17.21
Arima, Torrecilla Estate	0.15	4.21	7.08	12.82	1.29	3.37	3.67	28.04	26.46
Arima, Verdant Vale Estate	0.02	2.18	5.57	8.41	1.61	3.19	3.03	21.16	23.89
San Rafael, Constabulary Station	0.33	4.49	10.00	13.83	1.28	2.79	5.64	34.46	29.36
Guanapo, Talparo Estate	0.02	3.30	10.18	14.62	0.85	1.35	3.56	33.02	23.90
Guanapo, San José Estate	0.24	3.01	10.35	13.40	...	...	...	36.20	...
Tamana, Santa Marta Estate	0.40	3.55	10.04	12.59	2.35	1.70	5.25	33.97	30.74
<i>San Fernando de Princes Town District.</i>									
Claxton's Bay, Forbes Park Estate	0.02	3.09	3.75	9.53	0.17	1.39	1.36	21.23	10.89
Pointe-à-Pierre, Bonne Adventure Est.	0.24	2.23	4.54	9.76	0.32	1.08	1.88	23.40	16.15
" " Concord Estate	0.45	2.05	5.19	10.88	0.34	0.80	2.45	26.97	16.84
" " Plein Palais Estate	Nil.	1.56	3.39	10.05	0.21	0.89	1.05	20.17	12.29
Naparima, Picton Estate	Nil.	1.30	5.00	6.89	1.30	0.58	2.05	20.76	12.27
" Usine Ste. Madeleine Est.	0.36	1.55	5.31	8.21	0.94	1.68	2.00	22.04	14.90
" La Fortunée Estate	Nil.	2.56	4.34	4.86	0.73	0.60	2.75	17.13	11.56
" Lewisville	0.06	2.15	5.50	9.35	0.70	1.64	1.85	25.26	16.47

RAINFALL RETURN FOR MARCH TO JUNE, 1915.—CONTINUED.

STATIONS.	1915.				1914.				1915.	1914.
	March.	April.	May.	June.	March.	April.	May.	June.	June.	June.
	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
<i>San Fernando & Princes Town District.</i>										
—(Contd.)										
Naparima, Tarouba Estate...	Nil	1.43	2.14	4.49	0.28	0.54	0.86	5.93	17.72	9.34
" " Palmiste	Nil	2.88	4.16	6.37	0.53	1.63	1.98	6.70	16.48	13.37
" " Hermitage	0.07	2.00	4.94	8.45	0.63	0.96	1.98	8.15	21.76	13.91
" " Cedar Hill Estate	0.10	2.00	4.94	6.18	1.26	0.95	2.12	6.41	18.83	13.59
Sav. Grande, Craignish Estate	0.22	2.91	5.73	8.01	1.23	1.55	1.67	11.42	23.91	20.03
" " Williamsburg Estate	Nil	1.80	5.34	8.68	1.47	1.40	1.86	9.59	22.60	18.09
" " Emerald Estate	Nil	1.41	5.00	9.64	0.81	0.50	1.84	9.64	23.39	17.97
" " New Grant Estate	0.13	1.81	5.85	10.38	0.33	1.12	1.99	10.04	25.56	18.92
" " Constabulary Station	0.19	6.89	7.42	8.43	1.34	1.54	3.21	11.66	32.70	23.50
" " Hindustan Estate	0.17	1.96	4.41	6.70	0.69	0.55	1.27	7.48	19.28	11.84
" " La Retraite Estate	0.12	4.39	7.20	9.55	1.02	1.15	2.39	10.99	28.34	19.78
" " Malgretoute	0.27	5.23	10.17	12.31	1.70	1.75	3.81	16.03	33.66	32.35
" " Friendship & Ben Lomond Estates	0.13	2.25	6.28	9.55	1.04	1.36	1.75	10.98	25.17	18.62
Poolo, El Rosario Estate	0.11	2.23	5.19	8.55	0.89	1.56	1.29	8.96	22.95	15.69
" " South-West District.	0.11	3.09	11.63	15.05	1.53	0.87	3.38	15.57	36.23	26.93
Oropuche, Constabulary Station	Nil	3.20	4.93	5.28	1.57	1.95	5.71	8.06	22.04	20.03
" " Pluck Estate	0.09	1.92	5.33	5.40	0.87	1.17	3.04	5.79	20.01	13.30
Siparia, Constabulary Station	0.45	6.56	5.52	8.31	1.94	2.04	1.94	7.92	30.71	20.79
" " Alta Gracia Estate	0.39	4.85	4.10	6.51	...	...	...	...	22.33	...
Guapo, Adventure Estate	0.08	2.60	3.98	6.04	1.72	0.52	5.69	6.37	17.64	15.85
Point Fortin, Constabulary Station	0.19	3.60	4.72	6.24	2.62	1.67	4.63	10.80	21.26	22.71
Erin, La Ressource Estate	Nil	1.39	7.27	...	1.07	0.47	3.58	10.88	...	19.27
" " Industry Estate	0.08	2.91	5.48	5.77	1.70	0.43	3.29	12.03	19.44	21.62
Cedros, Ste. Marie Estate	Nil	1.11	5.89	3.70	...	...	...	...	15.88	...
" " Constabulary Station	0.06	1.41	7.06	3.74	1.50	0.32	2.11	8.74	17.32	18.61
" " La Retraite Estate	0.05	3.90	5.88	4.51	1.90	0.31	1.58	...	20.60	...
" " Penseverance Estate	Nil	1.08	7.19	4.22	1.90	0.31	...	...	17.67	16.45
" " Beaulieu Estate	0.02	1.83	5.98	5.94	...	...	...	...	13.83	...

RAINFALL RETURN FOR MARCH TO JUNE, 1915.—Continued.

STATIONS.	1915.				1914.				1915.	1914.
	March.	April.	May.	June.	March.	April.	May.	June.	Jan'y to June.	Jan'y to June.
<i>South-West District.—(Contd.)</i>										
Iscos, Constance Estate	0.10	1.70	6.25	5.24	0.65	0.09	1.14	6.38	Ins.	Ins.
Irol, Government School	Nil	4.26	4.51	4.09	2.01	1.07	3.25	10.14	17.79	10.19
<i>South Coast.</i>									21.34	21.28
Moruga, Constabulary Station	0.05	1.76	5.08	11.46	1.66	1.09	1.41	6.85	23.31	14.44
<i>East Coast.</i>										
Matura, La Juanita Estate	0.19	5.08	8.12	14.73	1.73	1.57	4.72	12.41	32.18	25.25
Manzanilla, Constabulary Station	0.41	4.68	10.89	16.15	1.60	2.10	2.91	13.16	39.46	24.86
Sangre Grande, New Lands Estate	0.16	3.54	12.44	11.05	1.68	3.61	4.51	10.81	36.72	26.72
" Evesdale Estate	0.29	5.61	8.90	15.47	2.34	3.96	4.41	12.98	37.96	30.83
" Grosvenor Estate	0.36	7.23	10.01	16.13	1.99	3.71	3.44	11.57	41.88	29.82
Mayaro, Constabulary Station	0.19	1.97	7.39	12.88	1.17	2.05	2.38	8.32	28.91	17.33
Sangre Grande, San Hilario Estate	...	...	...	14.95	...	...	...	...	...	...
<i>North Coast.</i>										
Blanchisseuse, Constabulary Station	0.08	1.29	7.61	4.71	0.37	0.47	4.98	11.04	18.41	21.40
Grande Rivière, Mon Plaisir Estate	0.35	4.30	13.73	7.04	2.30	2.00	7.85	9.40	39.87	58.70
Toco, Aragua House	0.82	4.31	4.83	11.81	1.05	1.04	2.59	11.53	27.81	21.36
" Constabulary Station	0.51	5.03	5.08	10.63	1.19	0.95	2.85	9.80	19.95	19.56
Point Galera, Light House	0.03	3.24	4.03	7.70	0.48	0.17	1.93	5.55	16.81	10.56
<i>Tobago.</i>										
Tobago, Hermitage Estate	0.35	8.01	5.34	3.44	2.37	1.74	3.32	6.74	22.01	20.48
" Riversdale	0.07	2.98	4.65	4.93	1.06	0.27	1.64	4.85	17.76	11.06
" King's Bay	0.14	7.26	7.38	4.63	1.94	0.96	3.09	6.21	25.06	19.80
" Roxburgh	0.18	6.45	7.99	6.28	3.32	0.85	3.55	8.23	28.71	33.24
" Lure	0.10	6.05	5.67	4.57	2.79	1.31	3.56	10.47	24.48	25.84
" Botanic Station	0.13	6.48	5.14	4.46	1.24	0.47	2.51	6.61	20.33	14.37
" Government Farm	0.05	3.08	2.85	3.02	0.79	0.03	0.71	3.41	11.79	6.45
" Lowlands Estate	0.05	4.28	4.46	4.29	0.47	0.21	1.05	5.96	17.25	10.43
" Friendship Estate	Nil.	3.91	5.34	4.56	0.61	0.56	2.06	6.04	18.08	13.29
" Bon Accord Estate	0.04	3.96	3.75	3.29	...	...	...	...	14.59	...

NOTES.

Professor P. Carmody sailed for England on July 12, on six weeks' leave. During his absence Mr. W. G. Freeman is acting as Director of Agriculture, and Mr. H. S. Shrewsbury as Government Analyst.

The Board of Agriculture decided at its meeting in June to combine its publications with those of the Department, and they will appear now in this *Bulletin*. An editorial committee was appointed comprising the the Director, the Assistant Director, the Mycologist, Entomologist, and Superintendent of Field Experiments.

Mr. Joseph de Verteuil, F.C.S., Superintendent of Field Experiments has been granted three months leave from July 5.

Mr. F. W. Urich who, since the foundation of the Board of Agriculture in 1908, has been seconded from the Education Department, has resigned his substantive appointment in the Government Service and is now solely an officer of the Board of Agriculture.

Mr. L. A. Brunton has been appointed Assistant Superintendent of Field Experiments in the Department of Agriculture from August 1. Since April, 1909 he has been an Agricultural Inspector under the Board of Agriculture.

Mr. H. A. Davis has been appointed after a theoretical and practical examination as an Agricultural Inspector under the Board of Agriculture, thus raising the number of Inspectors to three. Mr. Davis was formerly a pupil of the Agricultural School, St. Vincent. He then became a student at St. Clair Experiment Station, leaving to enter the service of the German Kali Manurial Agency, in which connection, he took part in field demonstration work in Trinidad and other parts of the West Indies. More recently he has been employed on cacao estates in Trinidad.

The examiners were: Mr. A. B. Carr (cacao planter and member of the Board), the Assistant Director of Agriculture, the Mycologist, and the manager of River Estate.

The district of the new Inspector will be Tobago and the North Coast of Trinidad.

BULLETIN

OF THE
DEPARTMENT OF AGRICULTURE,
Trinidad and Tobago.

PART 5.]

1915.

[VOL. XIV.]

SUGAR.

MANURIAL EXPERIMENTS ON SUGAR CANE, 1912-15.

By JOSEPH DE VERTEUIL, F.C.S.,
Superintendent of Field Experiments.

THIS report deals with the results obtained as first ratoons and is in continuation of the report for 1912-14 (1). As mentioned in last year's report which contains a diagram of the arrangement of the plots, each experiment has been made on eight equal plots similarly treated; accordingly the result given for each plot is the mean of eight duplications. These experiments have been made on the Brechin Castle, Esperanza and Malgretoute estates.

The kind and quantity of manures applied per acre to the plots on each estate were as follows :—

	<i>Plant canes per acre.</i>	<i>First Ratoons per acre.</i>
Plot 1.	<div> <div>45 lb. nitrogen, from calcium nitrate.</div> <div>40 lb. phosphates, from dissolved bones.</div> <div>28 lb. potash, from sulphate of potash.</div> </div>	45 lb. nitrogen, from calcium nitrate.
Plot 2.	<div> <div>45 lb. nitrogen, from sodium nitrate.</div> <div>40 lb. phosphates, from dissolved bones.</div> <div>28 lb. potash, from sulphate of potash.</div> </div>	45 lb. nitrogen, from sodium nitrate.
Plot 3.	<div> <div>45 lb. nitrogen, from calcium cyanamide.</div> <div>40 lb. phosphates, from dissolved bones.</div> <div>28 lb. potash, from sulphate of potash.</div> </div>	45 lb. nitrogen, from calcium cyanamide.
Plot 4.	<div> <div>45 lb. nitrogen, from sulphate of ammonia.</div> <div>40 lb. phosphates, from dissolved bones.</div> <div>28 lb. potash, from sulphate of potash.</div> </div>	45 lb. nitrogen, from sulphate of ammonia.
Plot 5.	<div> <div>45 lb. nitrogen, from sulphate of ammonia.</div> <div>40 lb. phosphates, from dissolved bones.</div> </div>	45 lb. nitrogen, from sulphate of ammonia.
Plot 6.	<div> <div>45 lb. nitrogen, from sulphate of ammonia.</div> <div>40 lb. potash, from sulphate of potash.</div> </div>	45 lb. nitrogen, from sulphate of ammonia.
Plot 7.	45 lb. nitrogen, from sulphate of ammonia.	45 lb. nitrogen, from sulphate of ammonia.
Plot 8.	Control.—No manure.	Control.—No manure.

The cost of manuring includes the value of the manures landed in Port-of-Spain and the cost of application.

The value of the canes reaped has been calculated on a basis of \$2.40 (10s.) and \$3.00 (12s. 6d.) per ton. At the former price several plots show a loss, whereas these same plots show a profit when canes are valued at \$3.00 per ton (*Vide* plots 1, 6 and 7, Table III, and plot 7. Table V).

The juice from the canes reaped on each plot at Brechin Castle, was sampled at the factory-mill and analysed by Dr. A. Urich, Ph. D., F.I.C. to whom my thanks are due for his kind assistance. The samples from Esperanza were personally taken and analysed by me on the spot at the estate's laboratory.

The quality of the juice from the plots and from the whole estate generally has been inferior this year as compared with last year. This may be due to the heavy rains experienced at the end of December, 1914 and the first week of January, 1915. From this period there was an abrupt change in the weather and practically no rain was registered on the Brechin Castle and Esperanza estates up to the date of cutting the canes.

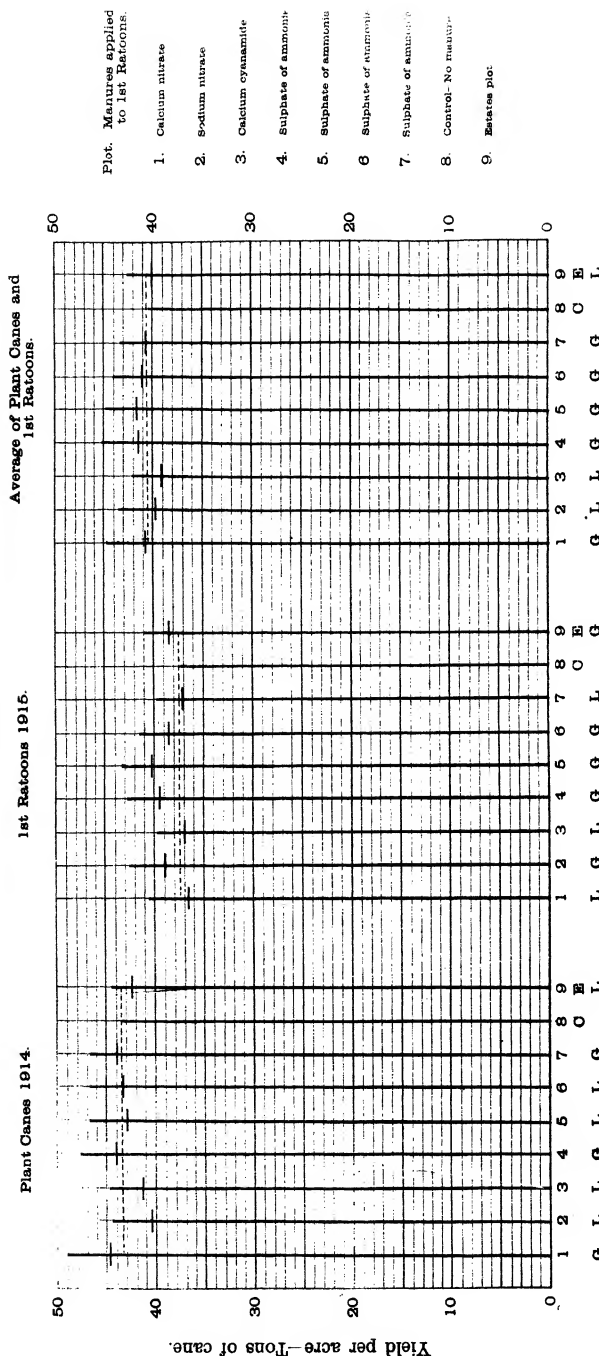
The tonnage of canes reaped per acre and the pecuniary results obtained for each plot on the three estates, are shown graphically in diagrams I, II and III.

RAINFALL.

The rainfall on each estate during the period of growth for the year is given below :—

		<i>Brechin Castle.</i>	<i>Esperanza.</i>	<i>Malgretoute.</i>
		inches.	Inches.	Inches.
March,	1914	... 0.26	... ..	...
April,	"	... 1.55	1.70	...
May,	"	... 2.10	2.08	...
June,	"	... 8.90	7.62	10.98
July,	"	... 5.00	4.96	6.42
August,	"	... 3.45	2.98	4.15
September,	"	... 9.15	9.14	5.00
October,	"	... 5.75	6.15	5.16
November,	"	... 6.77	6.17	5.66
December,	"	... 6.00	5.05	10.44
January,	1915	... 4.16	5.88	5.19
February,	"	... 0.78	0.88	1.77
March	"	... ..	0.05	0.18
April,	"	... ..	...	2.25
May,	"	... ..	...	6.28
		58.82	51.51	68.48

Diagram I. — Brechin Castle Estate. — Cane B. 156.



EXPLANATION OF DIAGRAM.

The plots are indicated by the numbers 1, 2, 3, 4, etc.
C means Control; H = Heavier; M = Medium; L = Light.
Each distance from 0 to 10, 10 to 20, etc., represents ten (10) tons of cane per acre and therefore the space from any one horizontal line to the next is equivalent to one (1) ton of cane or \$3 from a monetary point of view.

The dotted red lines indicate the yield of the Control plot throughout each series of the experiments. The portions of the vertical lines above the short horizontal black marks represent the quantity of osame, valued at \$3 per ton, required to pay for the cost of manuring. When the black dash comes above the red line a profit has been obtained, when below it shows a loss. The vertical distance from the red line to the dash, above or below, is equivalent to the gain or loss resulting from the manuring. The distance between two horizontal lines and above or below, represents a gain of approximately 100 bushels of wheat per acre. The dotted red line represents the cost of manuring.

BRECHIN CASTLE ESTATE—COUVA.

The manures were applied to the experiment plots on June 13, and 2 cwt. sulphate of ammonia per acre were applied to the estate plots, 9 and 10 on June 20, 1914.

Each of the estate plots is equal in size to the whole of the experiment plots, *i.e.* approximately two acres.

The canes were reaped between March 12 and 20, 1915, and were twelve months old. Owing to an accident in transport, the canes from the control plot 8 were not weighed until about 48 hours after being cut. From his long experience as a sugar planter, Mr. Arbuckle was in a position to suggest that an allowance of 10 cwt. be made for loss of weight through evaporation. This amount was accordingly added to the actual weight recorded in order that the control plot should not be at a disadvantage.

One half of the plots—Series A—was treated with the same manures as applied to the plants in 1913 and the other half—Series B—was treated with the nitrogenous manures only as shown on page 146. The results obtained are shown separately in Tables I and II, and the results for the two series A and B, for the two years, *i.e.* as plant canes and first ratoons, are given in Table III.

TABLE I—MANURIAL EXPERIMENTS, BRECHIN CASTLE ESTATE, COUVA—
SERIES A.—FIRST RATOONS B. 156.

PLOT.	MANURES APPLIED TO PLANT CANES AND 1ST RATOONS.	PER ACRE.						
		Yield of Canes.	Increase or De- crease of <i>no</i> manure.	Value of Increase or Decrease, at \$2.40 per ton.	Cost of Manuring.	Profit or Loss on <i>no manure</i> when canes are worth, per ton.		Results obtained from plant canes in 1914, when canes are worth \$3.00 (12s. 6d.) per ton.
						\$2.40 (10s.)	\$3.00 (12s. 6d.)	
		Tons.	Tons.	\$ c.	% c.	\$ c.	% c.	\$ c.
1	{ Calcium nitrate Dissolved bones Sulphate of potash }	39.89	+ 2.51	+ 6.02	13.09	- 7.07	- 5.56	+ 3.11
2	{ Sodium nitrate Dissolved bones Sulphate of potash }	43.03	+ 5.65	+ 13.56	12.21	+ 1.35	+ 4.74	- 9.69
3	{ Calcium cyanamide Dissolved bones Sulphate of potash }	38.90	+ 1.52	+ 3.65	10.02	- 6.37	- 5.46	- 7.08
4	{ Sulphate of ammonia Dissolved bones Sulphate of potash }	42.54	+ 5.16	+ 12.38	11.31	+ 1.07	+ 4.17	+ 0.33
5	{ Sulphate of ammonia Dissolved bones }	45.00	+ 7.02	+ 18.29	9.87	+ 8.42	+ 12.99	- 0.75
6	{ Sulphate of ammonia Sulphate of potash }	38.61	+ 1.23	+ 2.95	9.66	- 6.71	- 5.97	- 0.66
7	Sulphate of ammonia...	39.94	+ 2.56	+ 6.14	8.22	- 2.08	- 0.54	+ 0.63
8	Control—No manure ...	37.38	...	...	...	...	...	...

TABLE II.—MANURIAL EXPERIMENTS.—BRECHIN CASTLE ESTATE, COUVA.—
SERIES B.—FIRST RATOONS. B. 156.

PLOT.	MANURES APPLIED TO FIRST RATOONS.	PER ACRE.						
		Yield of Canes.	Increase or decrease on <i>no manure</i> .	Value of increase or decrease at \$2.40 per ton.	Cost of manuring.	Profit or loss on <i>no manure</i> when canes are worth, per ton.		Averages of series A & B, when canes are worth \$3.00 (12s. 6d.) per ton.
						\$2.40 (10s.)	\$3.00 (12s. 6d.)	
		Tons.	Tons.	\$ c.	\$ c.	\$ c.	\$ c.	\$ c.
1	Calcium nitrate ...	40.97	+3.59	+ 8.62	9.90	- 1.28	+0.87	- 2.34
2	Sodium nitrate ...	41.76	+4.38	+10.51	9.02	+1.49	+4.12	+4.42
3	Calcium cyanamide ...	40.48	+3.10	+ 7.44	6.83	+0.61	+2.47	- 1.49
4	Sulphate of ammonia...	42.93	+5.55	+13.32	8.12	+5.20	+8.53	+6.37
5	Sulphate of ammonia ...	41.36	+3.98	+9.55	8.12	+1.43	+3.82	+8.41
6	Sulphate of ammonia ...	41.41	+7.03	+16.87	8.12	+8.75	+12.97	+3.50
7	Sulphate of ammonia...	39.94	+2.56	+ 6.14	8.12	- 1.98	- 0.44	- 0.49
8	Control—No manure ...	37.38	...	...	...	...	...	...
9	{ Estate plot A. Sulphate of ammonia }	40.09	...	...	...	...	...	...
10	{ Estate plot B. Sulphate of ammonia }	41.98	...	...	...	...	...	...
	Average of Estate's plots	41.03	+3.65	+ 8.76	8.12	+ 0.64	+ 2.83	+ 2.83

The results recorded in Tables I and II represent the average of four duplications each. On comparing the results for the corresponding plots in each of the these tables it will be seen that no benefit has been derived from the re-application of the mixed manures to series A—three plots 1, 3 and 6 show a loss whereas there are none in series B, when the canes are valued at \$3.00 per ton. Plot 7 shows a loss in both series but this plot was treated with sulphate of ammonia alone.

If we compare the results recorded in Table II - under the head "average of series A and B," it will be seen that there has been a loss of \$2.84 and \$1.49 from the calcium nitrate and calcium cyanamide plots 1 and 3, whereas the sulphate of ammonia and sodium nitrate plots 4 and 2 show a profit of \$6.87, and \$4.42 respectively.

On comparing the results from plots 4 to 7, it will be seen that there has been a loss of \$0.49 from plot 7 to which sulphate of ammonia alone was applied to the plant canes and first ratoons, whereas plots 5, 4 and 6 show a profit of \$8.41, \$6.37 and \$3.50 respectively.

The average of the estate plots has given a profit of \$2.83 per acre.

TABLE III—MANURIAL EXPERIMENTS, BRECHIN CASTLE ESTATE, COUVA—
AVERAGE OF SERIES A & B—PLANT CANES & FIRST RATOONS B 156.

PLOT.	PER ACRE.							
	YIELD OF CANES.				Value of Increase or Decrease at \$2.40 per ton.	Cost of Manur- ing.	Profit or Loss on no manure when canes are worth, per ton.	
	Plant Canes 1914.	1st Ratoons 1915.	Average of plant canes and 1st ratoons.	Increase or De- crease on no manure.			\$2.40 (10s.)	\$3.00 (12s 6d)
	Tons.	Tons.	Tons.	Tons.	\$ c.	\$ c.	\$ c.	\$ c.
1	48.97	40.43	44.70	+ 4.23	+ 10.15	12.29	- 2.14	+ 0.40
2	44.41	42.39	43.40	+ 2.93	+ 7.03	11.41	- 4.38	- 2.62
3	44.55	39.69	42.12	+ 1.65	+ 3.96	9.22	- 5.26	- 4.27
4	47.45	42.74	45.09	+ 4.62	- 11.09	10.51	+ 0.58	+ 3.35
5	46.61	43.18	44.89	+ 4.42	+ 10.61	9.43	+ 1.18	+ 3.83
6	46.57	41.51	44.04	+ 3.57	+ 8.57	9.27	- 0.70	+ 1.44
7	46.52	39.94	43.23	+ 2.76	+ 6.62	8.17	- 1.55	+ 0.11
8 Control--No manure...	43.57	37.38	40.47	...	...	...	...	...
Estate Plot A ...	46.06	40.09	...	...	...	...	...	...
Estate Plot B ...	42.18	41.98	...	...	...	...	...	...
Average of Estate's plots ...	44.12	41.03	42.57	+ 2.10	+ 5.04	6.70	- 1.66	- 0.40

The figures recorded in the above table are the average of the results for plant canes and first ratoons and represent the average of eight duplications for each plot in each year.

From this table it will be seen that over the period of 2 years in the complete manure series, viz :—plots 1 to 4, the calcium nitrate and sulphate of ammonia plots 1 and 4 have given a profit of \$0.40 and \$3.35, whereas the sodium nitrate and calcium cyanamide plots 2 and 3 show a loss of \$2.62 and \$4.27 respectively when canes are worth \$3.00 per ton.

In the first year's report (1) it was pointed out that no benefit had been derived from the application of phosphates and potash with sulphate of ammonia or from the application of phosphates or potash alone with sulphate of ammonia to plant canes. The results obtained for the two years, i.e. the average for the plant canes and first ratoons show that there has been a profit of \$3.24 from the application of the complete manure

over sulphate of ammonia alone (*vide* plots 4 and 7 Table III). There has also been a profit of \$8.72 and \$1.38 from the application of phosphates and potash respectively to the sulphate of ammonia (*vide* plots 5, 6 and 7 Table III).

If we compare the results from plots 4, 5 and 6 it will be seen that a gain has been obtained by the addition of phosphates to the sulphate of ammonia and potash plot 6 but no benefit has been derived from the application of potash to the sulphate of ammonia and phosphate plot 5.

The average for the estate plots shows a loss of \$0.40 over the two years.

RESULTS OF ANALYSIS OF JUICE FROM THE EXPERIMENT PLOTS—
BRECHIN CASTLE.

Plot.	Brix.	Percentage of		Quotient of purity.	lb. Sucrose per gal.	Remarks.
		Sucrose.	Glucose.			
1	16.0	12.77	Not Estimated.	79.8	1.358	
2	16.1	12.93		80.3	1.376	
3	16.7	13.16		78.8	1.403	
4	16.2	12.71		78.4	1.350	
5	16.1	12.61		78.3	1.342	
6	16.4	12.90		78.6	1.373	
7	17.5	13.18		75.3	1.404	
8*	17.1	11.83	2.95	69.2	1.252	

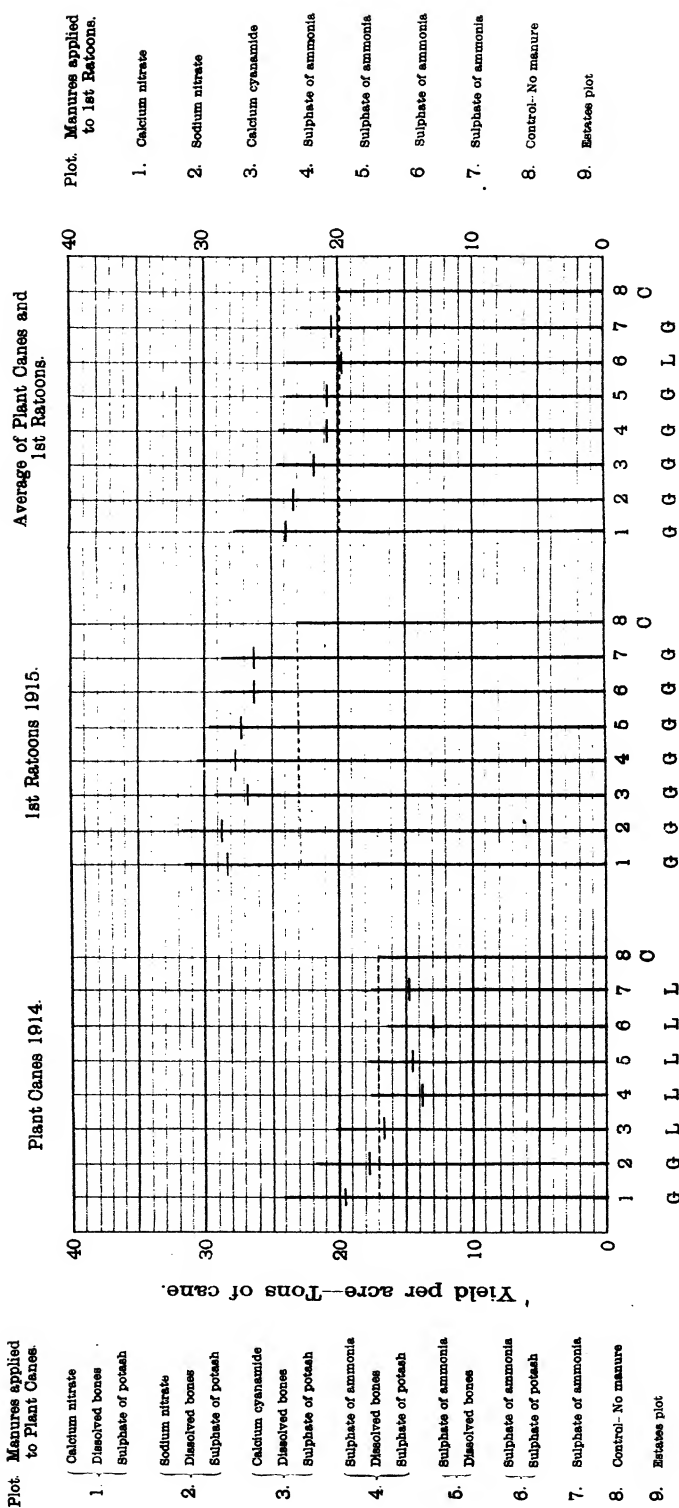
Mill extracts about 63 percent. juice.

ESPERANZA ESTATE—CALIFORNIA.

The manures were applied to the plots on June 28, 1914 and the canes were reaped between April 20 and 22, 1915, *i.e.*, about 12 months after they had been cut as plant canes. The results obtained from the first ratoons are given in Table IV and the average for the plant canes and first ratoons in Table V.

* Juice analysed about sixty hours after the canes were cut, owing to an accident during transport of the canes.

Esperanza, Estate.



Explanation of Diagram--Vide Diagram I.

TABLE IV.—MANURIAL EXPERIMENTS—ESPERANZA ESTATE, CALIFORNIA—
FIRST RATOONS B. 147.

PLOT.	MANURES APPLIED TO FIRST RATOONS.	PER ACRE.						
		Yield of Canes.	Increase or decrease on <i>no manure</i> .	Value of increase or decrease at \$2.40 per ton.	Cost of manuring.	Profit or loss on <i>no manure</i> when canes are worth, per ton.		Results obtained from plant canes in 1914, when canes are worth \$3.00 (12s. 6d.) per ton.
						\$2.40 (10s.)	\$3.00 (12s. 6d.)	
		Tons.	Tons.	\$ c.	\$ c.	\$ c.	\$ c.	\$ c.
1	Calcium nitrate ..	31.44	+ 8.56	+ 20.54	9.90	+ 10.64	+ 15.78	+ 8.30
2	Sodium nitrate .	31.78	+ 8.90	+ 21.36	9.02	+ 12.38	+ 17.68	+ 2.37
3	Calcium cyanamide...	29.06	+ 6.18	+ 14.83	6.83	+ 8.00	+ 11.71	- 0.21
4	Sulphate of ammonia.	30.42	+ 7.54	+ 18.10	8.12	+ 9.98	+ 14.50	- 9.00
5	Sulphate of ammonia.	29.74	+ 6.86	+ 16.46	8.12	+ 8.34	+ 12.46	- 6.87
6	Sulphate of ammonia.	28.83	+ 5.95	+ 14.28	8.12	+ 6.16	+ 9.73	- 11.43
7	Sulphate of ammonia.	28.83	+ 5.95	+ 14.28	8.12	+ 6.16	+ 9.73	- 6.57
8	Control—No manure	28.49	...	...	...	...	...	...
9	Estate plot A — No manure	22.81	...	...	...	...	...	...
10	Estate plot B — No manure	22.26	...	...	...	...	...	...
	Average of no manure plots 8, 9 and 10	22.88	...	...	...	...	...	...

The results obtained from the first ratoons at Esperanza show a substantial profit from all of the plots over the control or *no manure* plots. In the complete manure series, plots 1 to 4, it will be seen that the sodium nitrate plot has given the largest profit, viz.:—\$17.68 and that all the plots to which a complete manure has been applied to the plant canes have given a larger profit than plot 7 which has been treated with sulphate of ammonia alone during both years.

TABLE V.—MANURIAL EXPERIMENTS, ESPERANZA ESTATE, CALIFORNIA—
AVERAGE OF PLANT CANES AND FIRST RATOONS B. 147.

PLOT.	PER ACRE.							
	Yield of Canes.			Increase or decrease on no manure.	Value of increase or decrease at \$2.40 per ton.	Cost of manuring.	Profit or loss on no manure when canes are worth, per ton.	
	Plant canes 1914.	First Ratoons 1915.	Average of plant canes & 1st ratoons.				\$2.40 (10s.)	\$3.00 (12s. 6d.)
	Tons.	Tons.	Tons.	Tons.	% c.	% c.	% c.	% c.
1	24.06	31.44	27.75	+ 7.85	+ 18.84	11.49	+ 7.35	+ 12.06
2	21.79	31.78	26.78	+ 6.88	+ 16.51	10.61	+ 5.90	+ 10.03
3	20.20	29.06	24.63	+ 4.73	+ 11.35	8.42	+ 2.93	+ 5.77
4	17.70	30.42	24.06	+ 4.16	+ 9.98	9.71	+ 0.27	+ 2.77
5	17.93	29.74	23.83	+ 3.93	+ 9.43	8.99	+ 0.44	+ 2.80
6	16.34	28.83	22.58	+ 2.68	+ 6.43	8.89	- 2.46	- 0.85
7	17.48	28.83	23.15	+ 3.25	+ 7.80	8.17	- 0.37	+ 1.58
8 Control — No manure ...	23.15	28.49	...	...	...	...	...	...
Estate plot A — No manure ...	15.43	22.81	...	...	...	...	...	...
Estate plot B — No manure ...	17.79	22.26	...	...	...	...	...	...
Average of no manure plots 8, 9 and 10 ...	16.93	22.88	19.90	...	...	...	...	...

From the above table it will be seen that, over a period of two years, with the exception of plot 6, all the plots show a profit when canes are worth \$3.00 per ton. In the complete manure series, *i.e.* plots 1 to 4, the best results have been obtained from the calcium nitrate and sodium nitrate plots, 1 and 2. These show a profit of \$12.06 and \$10.08 respectively against a profit of \$5.77 and \$2.77 from the calcium cyanamide and sulphate of ammonia plots 3 and 4.

As was the case at Brechin Castle, no benefit was derived last year from the application of phosphates and potash with sulphate of ammonia

or from the application of phosphates or potash alone with sulphate of ammonia to the plant canes. The results obtained for the two years, *i.e.* the average for the plant canes and first ratoons show that there has been a profit of \$1.19 from the application of the complete manure over sulphate of ammonia alone (*vide* plots 4 and 7 Table V). There has also been a profit of \$1.22 from the application of phosphates, but no benefit has been derived from the application of potash to the sulphate of ammonia (*vide* plots 5, 6 and 7 Table V).

By comparing the results from plots 4, 5 and 6 it will be seen that a gain has been obtained by the addition of phosphates to the sulphates of ammonia and potash plot 6 but no benefit has been derived from the addition of potash to the sulphate of ammonia and phosphate plot 5.

RESULTS OF ANALYSIS OF JUICE FROM THE EXPERIMENT PLOTS—
ESPERANZA ESTATE.

Plot.	Brix.	Percentage of.		Quotient of purity.	lb. Sucrose per gal.	Remarks.
		Sucrose.	Glucose.			
1	17.1	14.69	1.62	85.9	1.572	Average of 2 analyses.
2	17.1	14.60	1.60	85.4	1.563	" " " "
3	17.0	14.76	1.57	86.8	1.579	" " " "
4	17.0	14.65	1.60	86.2	1.567	" " " "
5	17.1	14.77	1.65	86.4	1.581	" " " "
6	17.2	14.85	1.62	86.3	1.590	" " " "
7	17.3	15.08	1.60	87.2	1.615	" " " "
8	17.2	14.90	1.72	86.6	1.596	" " " "
9*	17.9	15.71	1.50	87.8	1.687	
10†	18.3	15.76	1.37	86.1	1.695	

Mill extracts about 59 per cent. juice.

MALGRETOUTE ESTATE—PRINCES TOWN.

The manures were applied to the experiment plots on July 20, 1914. The canes were reaped between June 10 and 12, 1915 and were 12 months old. The results obtained from the first ratoons are given in Table VI and the average for the plant canes and first ratoons in Table VII.

* 8 beds situated to the south of experiment plots.

† 8 beds situated to the north of experiment plots.

TABLE VI.—MANURIAL EXPERIMENTS, MALGRETOUTE ESTATE—PRINCES TOWN.—FIRST RATOONS B 6450.

Plot.	MANURES APPLIED TO FIRST RATOONS.	PER ACRE.						
		Yield of Canes.	Increase or decrease on no manure.	Value of increase or decrease at \$2.40 per ton.	Cost of manuring.	Profit or loss on no manure when canes are worth, per ton.		Results obtained from plant canes in 1914, when canes are worth \$3.00 (12s. 6d.) per ton.
						\$2.40 (10s.)	\$3.00 (12s. 6d.)	
		Tons.	Tons.	\$ c.	\$ c.	\$ c.	\$ c.	\$ c.
1	Calcium nitrate ..	20.03	+ 0.07	+ 0.17	9.90	- 9.73	- 9.65	- 3.10
2	Sodium nitrate ...	22.54	+ 2.58	+ 6.19	9.02	- 2.83	+ 0.27	- 5.79
3	Calcium cyanamide...	24.00	+ 4.04	+ 9.70	6.83	+ 2.87	+ 7.71	- 8.43
4	Sulphate of ammonia	22.82	+ 2.86	+ 6.86	8.12	- 1.26	+ 2.18	- 9.63
5	Sulphate of ammonia	22.91	+ 2.95	+ 7.08	8.12	- 1.04	+ 2.50	- 25.98
6	Sulphate of ammonia	21.90	+ 1.94	+ 4.66	8.12	- 3.46	- 1.14	- 13.65
7	Sulphate of ammonia	19.64	- 0.32	- 0.77	8.12	- 8.89	- 9.27	- 12.99
8	Control — No manure ...	19.96	...	...	...	...	...	...

The results obtained from the first ratoons at Malgretoute show that four plots, viz.: - 2, 3, 4 and 5 have given a profit when canes are worth \$3.00 per ton. In the complete manure series plots 1 to 4, it will be seen that there is a loss of \$9.65 from plot 1—the calcium nitrate plot—whereas a profit of \$7.71, \$2.18 and \$0.27 has been obtained from the calcium cyanamide, sulphate of ammonia and sodium nitrate plots respectively. With the exception of plot 1, all the plots have given better results than plot 7 to which sulphate of ammonia alone has been applied to the plant canes and first ratoons.

Diagram III. Malgretoute Estate. Cane B. 6450.

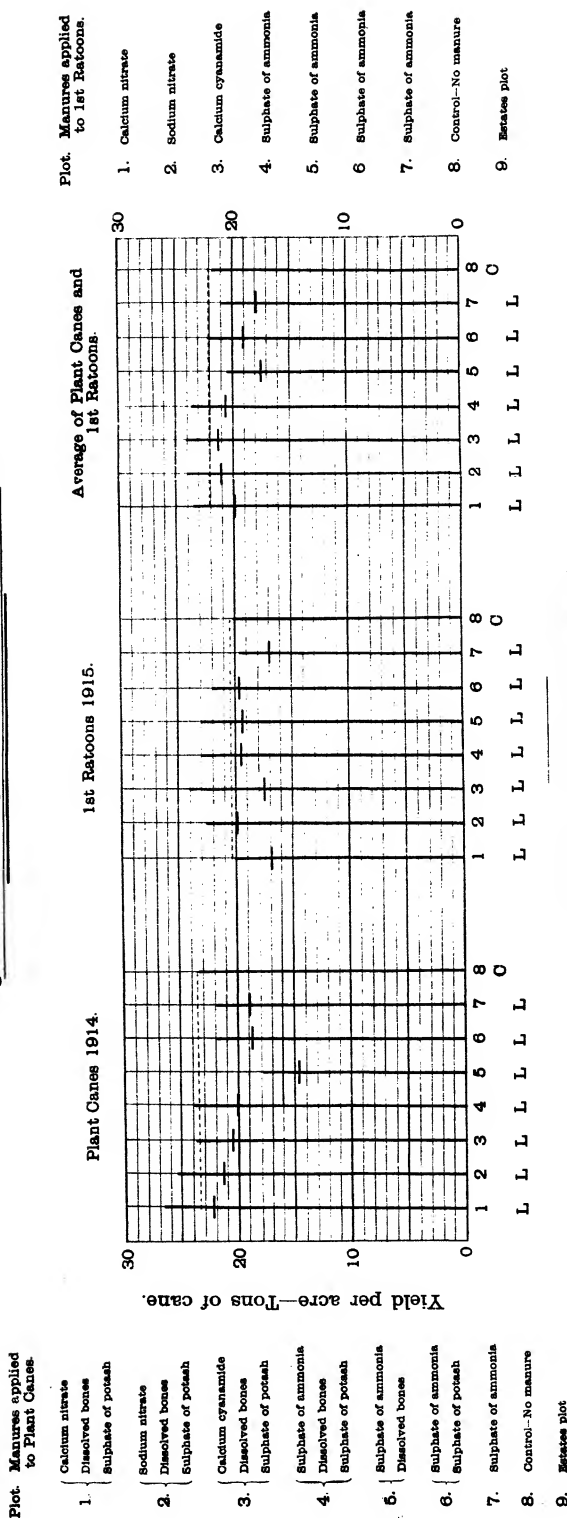


TABLE VII.—MANURIAL EXPERIMENTS, MALGRETOUTE ESTATE—PRINCES TOWN.—AVERAGE OF PLANT CANES AND FIRST RATOONS B 6450.

PLOT.		PER ACRE.							
		Yield of Canes.			Increase or decrease on <i>no manure</i> .	Value of increase or decrease at \$2.40 per ton.	Cost of manuring.	Profit or loss on <i>no manure</i> when canes are worth, per ton.	
		Plant canes 1914.	First Ratoons 1915.	Average of plant canes and first ratoons.				\$2.40 (10s.)	\$3.00 (12s. 6d.)
		Tons.	Tons.	Tons.	Tons.	\$ c.	\$ c.	\$ c.	\$ c.
1	...	26.54	20.03	23.28	+ 1.70	+ 4.08	11.49	- 7.41	- 5.37
2	...	25.35	22.54	23.94	+ 2.36	+ 5.66	10.61	- 4.95	- 2.11
3	...	23.74	24.00	23.87	+ 2.29	+ 5.50	8.42	- 2.92	- 0.18
4	...	23.77	22.82	23.29	+ 1.71	+ 4.10	9.71	- 5.61	- 3.55
5	..	17.14	22.91	20.37	- 1.21	- 2.90	8.99	- 11.89	- 13.35
6	...	21.88	21.90	21.89	+ 0.31	+ 0.74	8.89	- 8.15	- 7.77
7	..	21.62	19.64	20.63	- 0.95	- 2.28	8.17	- 10.45	- 11.59
8 Control — No manure		23.21	19.96	21.58	...	...	...	...	..

From the above table it will be seen that, over a period of two years, a larger tonnage of canes per acre has been obtained from the manured plots, with the exception of plots 5 and 7, than from the control plot. But the increased yield has not been sufficient to pay for the cost of manuring.

In the complete manure series plots 1 to 4, smaller losses have occurred in the calcium cyanamide and sodium nitrate plots. All the plots, except plot 5, have given better results than plot 7 to which sulphate of ammonia alone has been applied to the plant canes and first ratoons.

On this estate, owing to the undulating nature of the land on which these experiments were conducted it is advisable that the results should be accepted with reserve.

INSECTS AFFECTING THE SUGAR CANE IN TRINIDAD.

By F. W. URICH,
Entomologist, Board of Agriculture.

The following list has been compiled with the object of providing a handy reference to some of the principal insects affecting the sugar cane, their natural enemies and methods of control.

SUGAR CANE FROGHOPPER.

(1.) *Tomaspis varia*. Fabr. (Det. by Prof. E. D. Ball).

Common Name—The sugar cane frog hopper.

Natural enemies—

Names.	Stage of Froghopper affected.
<i>Birds.</i>	
The Scissors tail fly catcher (<i>Milvulus tyrannus</i> L.) The Merle Corbeaux, (<i>Crotophaga ani</i> , L.)	} Adults.
<i>Reptiles.</i>	
The ground lizards, (<i>Ameiva surinamensis</i> .)	... Adults and nymphs.
<i>Batrachia.</i>	
The toad, (<i>Bufo marinus</i>.) ... ...	.. Adults and nymphs.
<i>Arachnidae.</i>	
Several species of Attidae or jumping spiders (Predators).	Adults.
A mite, (<i>Rhyncholophus</i> sp.) (Parasite)...	... Adults.
<i>Insecta.—Orthoptera.</i>	
<i>Phlugis mantispa</i> (Predator). ...	... Adults.
<i>Hemiptera heteroptera.</i>	
The toad bug <i>Galgulidae</i> (Predator). ...	... Nymphs.
<i>Hymenoptera.—Formicidae.</i>	
<i>Anochetus inermis</i> (Predator)... ...	... Nymphs.
<i>Solenopsis geminata</i> (Predator) ...	... Adults and nymphs.
<i>Monomorium</i> sp. { " ) ..	... Eggs.
<i>Chalcidae.</i>	
Vermilion egg parasite, (<i>Oligosita giraulti</i>) Brown " " (<i>Paraphelinus tomaspidis</i>)	} Eggs.
<i>Diptera.—Syrphidae.</i>	
<i>Salpingogaster nigra</i> (Predator). ...	... Nymphs.
<i>Vermes.</i>	
<i>Mermis</i> species (Parasite) .. ...	... Nymphs.
<i>Fungoid Diseases.</i>	
Green Muscardine (<i>Metarrhizium anisopliae</i> , Sorokin) (Parasite) ... ... ...	... Adults and nymphs.
<i>Empusa</i> sp. (Parasite) . ...	... Adults.

Status—The froghopper is the worst insect pest of the sugar cane in Trinidad.

Control—Full descriptions of this insect, methods of control and information on natural enemies will be found in the following special publications :—

Board of Agriculture Circulars Nos. 7, 8, 9 and 11.

Department of Agriculture Circulars Nos. 5, 6 and 8.

Department of Agriculture Special Circulars 8 to 10.

GIANT MOTH BORER.

(2.) *Castnia licus*, Drury.

Common name—The giant moth borer.

Natural enemies—The Kiskadee, (*Pitangus sulphuratus*, L.)

Status—In some localities of the sugar cane districts *Castnia licus* does some damage, but it is not widespread enough to be considered a very serious pest; it is however never absent from sugar cane cultivation.

Control—Owing to the habits of the caterpillars they are well protected from natural enemies, and the best means of dealing with this pest is to cut out caterpillars from the cane stools and catch the adult moths.

SMALL MOTH BORERS.

(3.) *Diatraea saccharalis*, Fabr.

(4.) *Diatraea canella*, Hampson.

(5.) *Diatraea lineolata*, Walker.

All above determined by Dr. H. G. Dyar.

Common name—Small moth borer.

Natural enemies—Two egg parasites *Trichogramma minutum* and *Prophanurus* (*Telenomus*) sp.

An undetermined Tachina fly parasitic on the caterpillars.

An hymenopteron *Cyanopterus* sp. parasitic on the caterpillars.

The green muscardine fungus parasitic on caterpillars.

Status—Small moth borers are never absent from the fields but it is only occasionally that there is any serious outbreak. This can generally be put down to the absence of egg and other parasites, brought about by the burning of cane fields.

Control—When numerous, collection of egg masses, cutting out of larvæ and propagation of parasites.

CATERPILLARS.

(6.) *Remigia repanda* Fab.

Common name—The striped grass looper.

Natural enemies—The boat tail bird, (*Quiscalus lugubris*, Swains.)

The lizard, (*Ameiva surinamensis*.)

The toad, *Bufo marinus*.

A Tachina fly undetermined, parasitic on the caterpillars.

A *Chalcis* sp. parasitic on the pupæ.

The Jack Spaniard, (*Polistes canadensis*).

Status—The striped cane looper occasionally occurs in numbers on one or two fields of cane estates, these attacks generally take place at the opening of the rainy season and are often confined to one brood only. They can be put down to an absence of natural enemies.

Control—When caterpillars are numerous, dusting with Paris green, arsenate of lead or London purple is effective. Weeding a field when caterpillars are present does a great deal of good; the caterpillars are knocked off the canes, and when on the ground are devoured by the boat tail birds.

(7.) *Cirphis humidicola*, Guen. Det. by Dr. H. G. Dyar.

Common name—The cane bud caterpillar.

Natural enemies—The caterpillar is parasitized by an undetermined hymenopteron.

Status—Never absent from sugar cane fields, but at the same time not numerous enough to cause perceptible damage.

Control—Can be safely left to its natural enemies.

(8.) *Laphygma frugiperda*, S and A. Det. by Imperial Bureau of Entomology.

Common name—Corn bud worm, Southern grass worm.

Natural enemies—Insectivorous birds.

An undetermined *Tachina* fly has been bred from the caterpillar.

Status—As the name indicates, more a pest of corn than of cane, but when numerous on the former it spreads to sugar cane.

Control—Dusting with arsenicals.

(9.) } Undetermined species of Hesperid butterflies.
(10.) }

Common name—Cane skippers.

Natural enemies—Two species of Chalcid parasites affect the caterpillars and pupæ.

Status—Never numerous enough to be classed as pests.

(11.) *Caligo ilioneus saltus*, Fruhstorfer.

Common name—The Owl butterfly.

Natural enemies—The caterpillars are often parasitized by a *Tachina* fly.

Status—Not a pest by any means, although at times the butterflies are fairly numerous in the fields.

Control—The caterpillars can be left to their natural enemies.

BEETLES OR BORERS.

- (12.) *Metamasius hemipterus*, L. Det. by Imperial Bureau of Entomology.

Common name—Weevil borer.

Natural enemies—Larvæ of a histerid beetle prey on the larvæ.

Status—The larva of this beetle has never been found attacking perfectly healthy cane, but it occurs in conjunction with *Castnia licus* and *Diatraea*; it will also attack seed cane if for any reason fermentation sets in. It will also breed in cane damaged by rats.

Control—Always dip seed cane in Bordeaux mixture before planting.

- (13.) *Myochrous armatus*, Haly. Det. by Imperial Bureau of Entomology.

Common name—The cane bud beetle.

Status—Always present on cane estates, but never doing appreciable damage to full grown cane. If however numerous, it can be injurious to growing seed cane in nurseries, by eating off the young shoots.

Control—Dust or spray with arsenate of lead and keep vicinity of nurseries free from all grass.

- (14.) *Rhynchophorus palmarum*, L.

Common name—Gru-gru beetle.

Natural enemies—The larvæ are preyed upon by the larvæ of an Histerid beetle.

Status—The Gru-gru beetle or Palm weevil only attacks seed cane when it ferments from excessive moisture or from want of proper treatment before planting.

Control—Soak plants in Bordeaux mixture.

- (15.) *Xyleborus affinis*, Det. by Col. Winn Sampson, through Imperial Bureau of Entomology.

Common name—Shot hole borer.

Status—Never attacks healthy cane, but generally present on canes suffering from fungoid disease, especially rind fungus.

- (16.) *Strategus aloeus*, L. Det. by Imperial Bureau of Entomology.

Common Name—The Rhinoceros beetle.

Natural enemies—The larvæ are killed by the green muscardine fungus.

Status—Attacks on cane by the adult beetle are rare and generally occur in lands recently cleared on which there are many decaying trunks of trees.

Control—Remove or burn all rotting wood in which the larvæ breed.

MEALY BUGS AND SCALE INSECTS.

- (17.)
- Pseudococcus calceolariae*
- , Mask.
- Pseudococcus sacchari*
- , Ckll.

Common name—Mealy bug.

Natural enemies—The Coccinellid beetle, *Scymnus pictus*, Garh.

Status—Mealy bugs are never numerous enough on full grown cane to be injurious, and are generally kept in check by the Coccinellid mentioned. If neglected in connection with plants, they can be injurious.

Control—See that seed cane is free from all mealy bugs before planting.

- (18.)
- Aspidiotus sacchari*
- , Ckll.

Common name—The sugar cane *Aspidiotus*.

Natural enemies—An undetermined hymenopterous parasite.

Status—Not of any importance, occurring on diseased and old canes

GRASSHOPPERS.

- (19.)
- Schistocerca praesignata*
- , Rehn in M.S.S. Determined by Mr. J. A. G. Rehn.

Common name—Brown grasshopper.

Natural enemies—Several species of birds, but especially the tick bird (*Crotophaga ani*).

Status—Generally present in cane fields in small numbers and living on grass and cane leaves. Occasionally the young hoppers hatch in large numbers and affect a couple of acres of cane, but attacks are few and far between. These grasshoppers eat off the leaf tissue but leave the mid ribs.

Control—When numerous, dust or spray with arsenicals.

- (20.)
- Neoconocephalus guttatus*
- . Determined by Mr. J. A. G. Rehn.

Common name—The green cane Katydid.

Natural enemies—Birds prey on the young and adult stages. The eggs are generally parasitized by a small hymenopteron.

Status—Always present in cane fields, but never numerous. Their presence can always be determined by the manner in which they feed on the cane leaves, eating only the mid rib of the leaves.

- (21.)
- Homorocorypha*
- sp. allied to
- H. laticeps*
- . Determined by Mr. J. A. G. Rehn.

Common name—Brown cane Katydid.

Natural enemies—The same as No. 20.

CANE FLY.

- (22.)
- Delphax (Stenocranus) saccharivora*
- , Burin. Determined by Mr. O. Heidemann.

Common name—The cane fly.

Natural enemies—An undetermined Coccinellid preys on the nymphs and a species of Dryinid is parasitical on them as well.

Status—So far, the cane fly has never been numerous enough to be classed as a pest.

MOLE CRICKETS.

(23.) *Scapteriscus didactylus*, Latr.

Common name—Mole cricket.

Natural enemies—The lizard *Ameiva surinamensis*, *Crotophaga ani*, and Toads.

Status—Although mole crickets are numerous out of cane estates they rarely affect these plants, and for the last five years only one small attack has been observed. Only young growing plants are destroyed by this insect.

Control—According to Crossman and Walcott, mole crickets can be poisoned by the use of a mixture of flour 100 lb. and Paris green $2\frac{1}{2}$ to 3 lb. which should be scattered over the land before it is planted up. (See p. 172).

WHITE ANTS.

(24.) *Calotermes* sp.

Common name—White ants or wood lice.

Status—Not numerous enough to be classed as a pest, but occurring occasionally on stiff clay soil.

Control—Burn all nests found about the cane stools and in the field before planting up.

RICE.

RESULTS OF RICE EXPERIMENTS, 1914.

By JOSEPH DE VERTEUIL, F.C.S.,
Superintendent of Field Experiments.

DURING the season of 1914, experiments were started at St. Augustine with the object of determining the comparative yield of different varieties of rice grown under similar conditions. Four varieties were obtained and the nurseries made during the first week of July. Owing to the dryness of the weather, it was impossible to flood the land and to plant out the nurseries before the third week in August. During the whole of the growing season the rainfall was very poor and the results are consequently lower than would have been obtained under more favourable conditions.

The Department is indebted to Mr. A. H. Cipriani for the sample marked "A.H.C." which he imported from British Guiana for planting on Felicity Estate at Chaguanas. Unfortunately he was unable to give the name of the variety.

The varieties "H. 6" and "Creole Variant 2" were obtained from the Manager of St. Augustine, from seed grown during the previous season. These varieties were originally imported by the Agricultural Society of Trinidad from the Department of Agriculture, British Guiana.

The sample marked "Jerrahan" was obtained from an East Indian and is extensively grown by the Indians on the St. Augustine rice lands, but its origin is obscure.

The results obtained are given in the table below.

CULTIVATION RETURNS.

Description of Variety.	Area planted.	Date planted.	Distance planted.	Date reaped.	YIELD OF PADDY.	
					Per plot.	Per acre.
	sq. ft.				lb.	Bags of 120 lb.
"A.H.C." ...	11,000	August 20-22 ...	8" x 8"	November 18 ...	582	19'21
H. 6 ...	16,500	August 18-21 ...	8" x 8"	November 18-27	824	18'13
Creole Variant 2 ...	33,000	August 17-21 ...	8" x 8"	November 20-27	1,806	19'87
"Jerrahan" ...	24,900	August 22-26 ...	8" x 8"	December 22-29	1,117	16'28

It will be seen from the above table that there is little difference in the yield of paddy from the different varieties. Creole Variant 2 and the rice imported by Mr. A. H. Cipriani gave the best yield, viz.: 19'87 and 19'21 bags of paddy respectively.

The sample marked "Jerrahan" took fully a month more to mature than the others. During the reaping of this variety very heavy rains and floods were experienced and a small portion of the crop was unavoidably lost.

A sample of each variety was forwarded to the Trinidad Rice Mills, Limited with the object of having an expert opinion on their milling qualities. I wish to thank Mr. J. P. Farnum, Managing Director, for the kind assistance given and for the following report which was forwarded to the Department:—

“We have pleasure in submitting the following comments made by our milling expert, Mr. H. Conrad Teixeira, on the four bags of paddy received from the Department of Agriculture. Generally the quality is about equal; the sample ‘Jerrahan’ being somewhat smaller in grain than the others (this is in the way of a fault). All are of free milling quality. The milling resulted as follows:

MILLING REPORT.

Sample.	Condition of Sample.	Original weight received.	Prepared for milling.	Net after milling.	Percentage loss on original weight.	
		lb.	lb.	lb.		
H. 6	Water soaked	117	112	63	46·15	Would have given much better result but for preventable conditions.
Jerrahan	Good, clean	120	115	76	36·66	
A.H.C.	Good, slightly mud soiled	119	114	74	37·82	
Creole Variant	Good, very much mud soiled	123	117	75	39·03	

All of these samples afford evidence of want of care in reaping the paddy, a very general fault with the Trinidad paddy grower.”

PLANT DISEASES AND PESTS.

THE ANTHRACNOSE OF THE MANGO.

BY JAMES BIRCH RORER,
Mycologist, Board of Agriculture.

INTRODUCTION.

THE common varieties of mangos are so widespread throughout Trinidad and are of so little commercial value, that not much attention has ever been paid to their diseases or to the application of remedial measures. Within the past few years, however, many hundreds of grafted trees of good kinds have been planted, costing from twenty-four cents to one dollar each. As the capital outlay in these orchards is larger, and as the production of fruit of good varieties will soon exceed the local demand, a study has been made during the past five years of the various mango diseases and of the methods for their control. Experiments in packing storing and shipping of the fruits have also been made.

Anthracnose, sometimes called blossom-blight, leaf-spot or black fruit-spot, is by far the most common and destructive of all the mango diseases. It attacks almost every variety with greater or lesser virulence, and is found wherever mangos are grown. One often hears of a "good" or a "bad" mango year, and this is the direct result of the non activity or the activity of this disease.

Many writers have recorded the disease from different places. Fawcett, (1) Bessey, (2) and McMurran, (3) have studied the disease in Florida. The last named shows that in seasons of very moist showery weather, at blossoming time spraying with Bordeaux mixture is of little or no value in preventing the blighting of the blossoms, though it will keep the panicles and fruit free from infection, and that while total failures of the crop may occur, more often weather conditions favour a good set of fruit which can be easily protected by spraying. He also states that it is probably never so dry but that spraying will have to be resorted to in order to keep the fruit free from infection after it has set.

Collins, (4) has reported the disease from Porto Rico, Higgins (5) from Hawaii, and Cardin, (6) from Cuba. In all cases Bordeaux mixture has been recommended as a control.

Like other anthracnoses this disease is caused by a fungus belonging to the genus *Glœosporium* or *Colletotrichum*. It is known as *G. mangiferae*

(1.) Fawcett, H. S. "Bloom blight of the mango." *Report Agricultural Experiment Station, Florida, 1906*, p. 25, 1907.

(2.) Bessey, E. A. "Report on Plant Diseases." *Proceedings Twenty-first Annual Meeting, Florida State Horticultural Society*, p. 97, 1908.

(3.) McMurran, S. M. "The Anthracnose of the Mango in Florida." *Bulletin of the U. S. Department of Agriculture*, No. 52, pp. 15, 4 Plates. 1914.

(4.) Collins, G. N. "The Mango in Porto Rico," *U. S. Department of Agriculture. Bureau of Plant Industry, Bulletin 23*, p. 20, 1903.

(5.) Higgins, J. E. "The Mango in Hawaii," *Hawaiian Agricultural Experiment Station, Bulletin*, 12, p. 22, 1906, also in *Annual Reports of Hawaiian Agricultural Experiment Station*, from 1905 to 1912.

(6.) Cardin, P. P. "Bloom blight of Mango." *The Cuba Review*, Vol. 8, p. 28-29, 1910.

or *U. glaucosporioides*, an omniyorous parasite which not only attacks mangos, but avocados, citrus trees, and a variety of plants of no economic value.

Moreover, the work of Shear and Wood, (1) has shown that this fungus is probably identical with that causing similar diseases of the apple, grape, fig and guava.

As the common names suggest flowers, leaves and fruit are affected.

DESCRIPTION OF THE DISEASE.

On Flowers.—The attack on the flowers and flower stalks causes the most loss to the mango crop as it prevents fruit from setting. The flower stalks and floral organs may be infected at any time after the emergence from the bud to the setting of the fruit.

The first signs of disease are small dark spots which rapidly increase in size, many often coalescing so that frequently the whole flower stalk and all the floral branches become black. These diseased stalks do not set fruit but remain on the tree as a source of infection for later crops.

On Leaves.—The soft young leaves are the most easily infected by the fungus. The disease first appears as very minute black dots which increase in size as the leaf grows, until they attain a diameter of about $\frac{1}{8}$ to $\frac{1}{4}$ of an inch, rarely larger (Plate 1, fig. 4). The spots are not necessarily round but are often angular. The tissues immediately surrounding them are somewhat lighter than the rest of the leaf. The diseased areas sometimes fall out when the leaves become old, giving them a shot hole appearance. The damage done to the leaves is sometimes quite severe, for when badly attacked they become distorted and fall prematurely, and in any case, there is a distinct reduction in their assimilative surface.

On Fruit.—The fungus may attack the fruit during any stage of its development. Young fruits, a week or two old, often become so severely infected that they fall from the trees in large numbers. On the older fruits the disease takes the form of black spots, which not only make the mangos unsightly, but spoil their keeping quality. The characters of the spots vary greatly. On some varieties, the "Gordon" for example, (Plate 1, fig. 1) the spot is irregular in shape and often shows cracks in the skin, while in other varieties like the "Calabash," the spots are round and sunken, (Plate 1, fig. 2). In bad infections the spots may coalesce so that the whole fruit becomes black. The spots are not merely superficial, but extend into the flesh, often to the seed itself. Spotted fruits rot very quickly as they approach the condition of ripeness.

Tear streaking and russetting of the mango (Plate 1, fig. 3) is due to the same fungus. These forms of the disease, which are most often seen on the more resistant varieties, "Julio" for example, can generally be traced back to the base of a dead flower stalk or shoot on which the fungus is growing. Drops of rain water or dew collect on these branches and when they fall carry numerous spores with them. Any of these drops which happen to run down the sides of a fruit, leave many of the spores behind sticking to the epidermis. The spores germinate and produce small lesions of the skin which do not penetrate into the flesh, but give a streaked appearance to the fruit.

(1.) Shear, C. L. and Wood, Ann. K. "Studies of Fungous Parasites belonging to the Genus *Glomerella*." U. S. Department of Agriculture, Bureau of Plant Industry, Bulletin 252, 1913.

INFECTION EXPERIMENTS.

Infection experiments carried out in the field and the laboratory show that all these diseases are caused by the same fungus, which can be isolated easily and grown in pure culture. The spores for inoculative purposes were taken from pure cultures and suspended in sterile distilled water, and sprayed on the plants with a small automizer. To test the effect of the fungus on leaves, seedling plants about four months old in bamboo pots were used. These plants were kept separate from other plants and the inoculation was done when they were making their second flush of leaves. Six plants were sprayed with sterile water containing the fungus spores and six were sprayed with sterile water. The inoculating was done late in the afternoon and for the next few days it was humid, with frequent light showers of rain, so that the conditions for infection were ideal. The plants were inoculated on November 2, and four days later innumerable small spots could be seen with the naked eye on the inoculated leaves, while the controls were perfectly clean. Two weeks later some of the inoculated leaves were picked off and the spots counted. Many of the larger leaves contained between nine hundred and one thousand infections while the very youngest leaves were so badly diseased that they were quite distorted, with the mid rib curved to one side and half of the tissues fallen away. Photographs showing these leaves are on file in the office of the Board of Agriculture.

The check plants only developed one or two spots on a few of the leaves.

In a similar way infection of flowers was made on inarched plants about one year old in bamboo pots. In inarching, the scion often puts out flowers during the first year of growth, and though these do not set fruit they are suitable for inoculation purposes. Three plants were sprayed with spores of *Glœosporium* suspended in water, while two were sprayed with sterile water as controls. Within a week, the floral organs and all parts of the flower stalk showed the small black spots characteristic of infection with the fungus, and in a short time all were entirely black. The controls showed no infection and dried up in the usual way.

Infection on fruits of different ages were obtained both on the tree and in the laboratory. Spores were sprayed on some fruits and placed with a needle on others, and the characteristic anthracnose always developed.

Of course, all these experiments were carried out in a country where mango trees are very common, and the fungus is present naturally in great abundance; but the fact that the inoculated plants and fruits in every case were very badly affected while the controls not at all, or only slightly so, may reasonably be considered proof that the fungus in question is the cause of the disease. Moreover, as stated above, the fungus belongs to a genus well known to be parasitic, the same or allied species having been proved to be the cause of fruit-rot of avocado, russeting, tear streaking, anthracnose and wither-tip of citrus trees, and fruit-rot or anthracnose of apple, grape, pear, tomato, eggplant, etc.

SPRAYING EXPERIMENTS.

During the winter of 1904, the writer spent a few weeks in Southern Florida and observed this disease on mango trees in the orchard of Professor Rolfs, then in charge of the Sub-tropical Laboratory of the United



FIG. 1. Anthracnose of mango



FIG. 2. Anthracnose of mango.

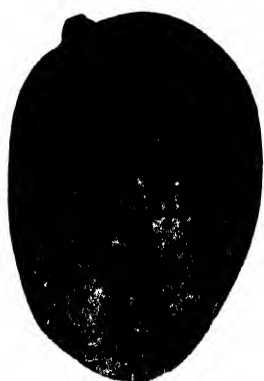


FIG. 3. Russet of mango.

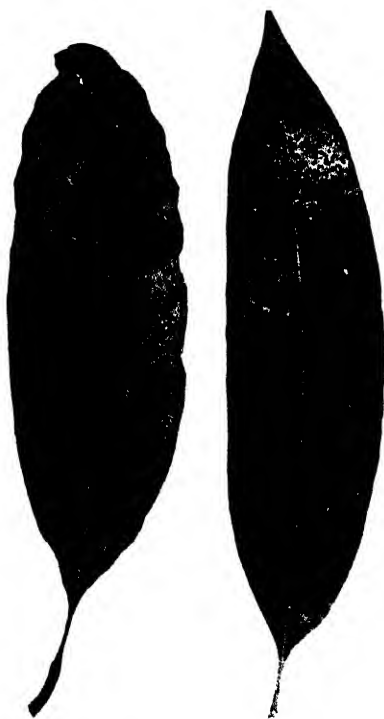


FIG. 4. Anthracnose of mango leaves.

States Department of Agriculture, now Director of the Florida Agricultural Experiment Station, who said that the disease could be controlled by the use of Bordeaux mixture applied at frequent intervals during the blossoming period.

The first spraying of mangos was started in Trinidad in 1910 on a large twenty-five year old "Julie" tree. Three applications were made at intervals of from six to ten days, but after the third application the owner thought that the Bordeaux mixture was causing the young fruit to fall so the work was discontinued. However, the tree set a good crop of fruit and has been sprayed thoroughly during the past three seasons.

As there are no mango orchards of bearing age in Trinidad, the older trees being more or less isolated or in small groups, it has not been possible to carry out any large experiments to determine the required number of sprayings, the best mixtures to be used, etc. Individual trees have been sprayed here and there and in 1912 and 1913 a small experiment was carried out at the Experiment Station which included most of the varieties growing there. All the trees are of about the same age and are planted on either side of a road. The following table will give an idea of the experiment:—

<i>Variety.</i>	SPRAYED.			UNSPRAYED.		
	<i>Number of Trees.</i>			<i>Number of Trees.</i>		
" Divine "	1	...	...	1	
" Minnie "	8	...	...	3	
" d'Or "	1	...	...
" Martin "	1	...	...
" No. 11 "	1	...	...	1	
" Julie "	4	...	...	3	
" de Boissière "	4	...	...	2	
" Peters "	4	...	...	4	
" Gordon "	2	...	...	1	
		<hr/> 21			<hr/> 15	

The trees were first sprayed in 1912 on February 8, at which time the majority were putting out flower buds, and were sprayed subsequently on the following dates—February 14, 21, March 8, March 15, March 28 and May 16. This was an excellent mango year throughout the island owing to the fact that the early months were very dry. The rainfall at the Experiment Station was as follows:—

February	...	...	...	·00 inches.
March	...	...	...	·74 "
April	...	...	...	·08 "
May	...	...	...	2·18 "
June	...	...	...	7·54 "
July	..	...	...	12·16 "

Despite the fact that February and March, the months of flowering, were dry, the very heavy dews at night gave sufficient moisture for fungus

infection, so that there was quite a good deal of blossom-blight and leaf-spot, though of course not nearly so much as in more normal seasons. The set of fruit on the sprayed trees was much heavier than that on the unsprayed. This was particularly noticeable on the very susceptible varieties, such as "Divine" and "Minnie."

The fruit began to ripen in the middle of June, and as the writer had no control over the picking of the fruit no counts could be made; yet far more fruit was gathered from the sprayed trees than from the unsprayed trees, and it was free from disease.

The result of spraying the "Divine," one of the varieties most susceptible to the disease, was very striking. Not only did the sprayed tree bear a magnificent crop but the fruits were very clean, making this variety a very attractive mango in appearance when free from disease. The fruit on the unsprayed tree was black and the skin was more or less cracked as a result of infection. Even in the case of the less susceptible varieties, where the disease took the tear-streaking form, the fruits from the sprayed trees were very much better in appearance.

The experiment was repeated in 1913, the same trees being sprayed on the following dates—January 31, February 7, 24, March 14, April 11 and May 15. This was another moderately dry year, the rainfall being as follows:—

February	...	...	...	50 inches.
March	...	...	...	1.42 "
April	...	...	...	.42 "
May	...	...	...	1.79 "
June	...	...	...	2.80 "
July	...	...	...	2.86 "

However, there were a number of showery days throughout the flowering time and blossom-blight was quite common. The beneficial results of the spraying were even more noticeable than in the previous year. All of the sprayed trees set more fruit than the control trees, and the greater part of the fruit ripened without infection, while the fruit on the unsprayed trees was for the greater part spotted or tear-streaked. The fruit from the sprayed trees matured a little later than that from the unsprayed and was somewhat larger in size. The foliage of the sprayed trees was much heavier than that of the unsprayed.

SHIPPING AND COLD STORAGE EXPERIMENTS.

Only a few experiments have been made by the writer in the shipping and cold storage of mangos because from the scattered plantings it is impossible to get well-grown and carefully picked fruit in any large quantity. Fruit which is sent to a distant market, especially if not very familiar to the purchasing public, should be of the very best quality, well-grown, free from disease, carefully picked and attractively packed.

In 1912 small experimental shipments of different varieties of mangos from the sprayed and unsprayed trees at the Experiment Station were made. Two boxes were sent to England and two to the United States. The fruits were hand-picked, and only those which were free from disease were packed. The picking and packing were done on the same day that the steamer sailed, and when taken on board the boxes were put in cold

storage at a temperature of about 36 degrees F. The two boxes for England were sent to Mr. A. W. Hill, Assistant Director, Royal Botanic Gardens, Kew, for examination and report. Forty-eight fruits were put in each box. The fruits were wrapped in tissue paper and packed tightly one against another, but no packing material was used. Sprayed and unsprayed fruit of the "Julie" variety were sent, but only sprayed fruit of "Gordon" and "Divine" as no absolutely sound fruit could be got from the unsprayed trees.

The fruit was shipped on June 24, and arrived at Kew on July 10.

The following is taken from Mr. Hill's report on the consignment:—

"Gordon"	...	...	...	10
"Divine"	...	...	...	15
"Julie" (unsprayed)	...	...	...	22
"Julie" (sprayed)	...	...	...	29
"Julie" (sprayed, less ripe)	...	...	...	19

"A few fruits were slightly bruised or squashed owing to pressure from the overlying fruit but none were rotten, and every fruit was edible. At the date of writing (July 16, twenty-two days after the fruit was picked) there are still nearly two dozen fruits not quite ripe.

"We were very much struck with the fine appearance of the sprayed fruits and they have not ripened so quickly since their arrival as the unsprayed "Julies."

"Of the more or less squashed fruits four were rather split but all could be eaten.

"The fruits have been appreciated by over forty people.

"The 'Gordons' did not meet with general favour as they have more of the turpentine flavour.

"I enclosed photographs which show the excellent state of arrival of the fruit which I hope may be of service.

"Since the mangos arrived we have had very hot weather which has made them ripen rather quickly."

Two boxes picked and packed in the same way were sent to the United States on June 15, but owing to a misunderstanding with the shipping company, the box was not put in cold storage but sent as ordinary cargo in the hold. Under these circumstances it could not be expected that the fruit would reach its destination in good condition, but the report on the shipment shows a marked difference in favour of the sprayed fruit. The fruit was sent to Mr. W. M. Scott, Entomologist and Pathologist of the Research Department of the Thomsen Chemical Company, Baltimore, Md. and was received and examined on June 28. Mr. Scott's report is as follows:—

"Gordon" sprayed.		"Julie" sprayed.		"Julie" unsprayed.	
9 sound	...	15 sound	..	0 sound.	
9 slightly affected	...	18 slightly affected	...	4 slightly affected.	
8 badly	"	16 badly	"	22 badly	"
5 seeds	...	1 seed	...	11 seeds.	

"I think you will understand what I mean by the classification above that is 'sound,' 'slightly affected,' 'badly affected,' and 'seeds.' The fruits that had completely rotted and dried, leaving nothing but the seeds were put down in the above table as 'seeds.' A considerable number of fruits had entirely disappeared except the seed.

"On the 'Gordon' the rot was entirely anthracnose, while the 'Julie' did not appear to be affected with this same disease. The trouble with the 'Julie' seemed to be due mainly to over-ripeness, but those that were mushy were evidently affected with some soft rot fungus. This variety went down without changing colour. No diseased spots like those produced by anthracnose appeared; the entire fruit collapsed without showing any external evidence of disease.

"The sprayed 'Julie' arrived in a decidedly better condition than the unsprayed of that variety. The thirteen fruits slightly affected were rather over-ripe, but still eatable, and were so slightly diseased that their quality was not materially impaired. In other words, that lot gave twenty-eight eatable fruits, while unsprayed of the same variety gave only 4 eatable fruits, none of which were perfectly sound.

"Of the 'Gordon' variety there were eighteen fine specimens, nine of which, however, were slightly diseased with anthracnose.

"We attempted to take some pictures of the 'Julie' and 'Gordon' varieties and will send them to you in a few days. Everybody in the office was given an opportunity to taste the fruits and we tried to get an opinion from them as to quality. Most of them preferred the 'Gordon,' I am rather fond of mangos and have enjoyed these very much. I took some home to Mrs. Scott and she ate them with relish. Most of the people here in the office do not like mangos and a couple of spoonfuls were sufficient in most cases. We have had a great deal of pleasure and considerable fun out of these mangos and thank you for sending them to us."

Apart from these shipments, a number of friends carried boxes of fruit from the sprayed and unsprayed trees, to England and New York during the years 1912 and 1913. The boxes were placed in the cold storage rooms on the ships which range from 36dg. to 40dg. F. and in every case the fruit reached its destination in excellent condition.

Although these trial shipments are very limited, they show that mangos can be shipped successfully in cold storage to either England or New York.

On August 12, 1913, four boxes of "Julie" mangos each containing two dozen fruits were put in in cold storage in Port-of-Spain, the temperature ranging from 38 dg. to 42 dg. F. Two of the boxes contained fruit from sprayed trees and two from unsprayed. All were of the "Julie" variety. The fruit was taken out and examined one month later and exhibited at a meeting of the Agricultural Society held September 12, 1913.*

The fruit, with one or two exceptions, had kept perfectly, and was in practically the same condition as it was when picked from the trees. After the fruit had been out of cold storage for a few days, however, the fruit from unsprayed trees began to deteriorate much more rapidly than that from sprayed trees, and after a week none were fit to eat. The sprayed fruits, with one or two exceptions, ripened gradually, and the last one was eaten ten days later, the fruit being kept at ordinary temperature in the meantime.

* Proceedings of the Agricultural Society of Trinidad and Tobago, Vol. XIII, pp. 435-6, September, 1913.

Four other boxes which were put in storage, 40dg. to 45dg. F., on August 12, 1918, were taken out on September 20, and transferred to the cold storage room on a ship for New York. On September 28, the fruits were taken out and examined. Externally, eighty per cent. of all the fruits was sound but the skin was slightly wrinkled. The taste however, was decidedly flat. The unsprayed fruit though sound externally, was soft rotted inside and was not at all fit to be eaten.

PICKING AND PACKING.

Great care should always be used in picking fruit for export. The fruits should be perfectly full, but not ripe. If too green when picked, mangos never develop the proper flavour, but always taste flat. Fruit should always be hand-picked, and cut from the tree with small pruning shears or orange scissors.

Too large boxes should not be used in packing mangos for shipment or for storage. If mangos are packed in crates holding more than one layer, the fruit not only becomes bruised, but begins to ripen before it can be cooled in the refrigerator. One or two ripe or mashed fruits in a crate will often spoil the whole lot. The most suitable type of box is one that will hold two dozen fruits. It should be 12 x 20 x 3 inches inside measurement, with a partition across the middle. This will give two compartments, each holding twelve mangos. The ends and sides of the box can be made of $\frac{3}{4}$ inch wood, but the top and bottom should be made of three strips $2\frac{1}{4}$ inches wide and a $\frac{1}{4}$ inch thick. Cleats $\frac{1}{4}$ inch thick should be put on the top edges of each box, so that there may be circulation of air between the boxes. The mangos should be wrapped in a single layer of clean tissue paper and packed on edge, and should project just slightly above the upper level of the box. The thin strips forming the tops and bottoms will then act as springs and hold the fruit in place. The corners of the box and the spaces between the fruits should not be filled up with packing material of any kind, as this would greatly retard the rapid cooling of the fruit.

MOLE CRICKETS.

The mole cricket (*Scapteriscus didactylus*, Latr.) is a well known pest in Trinidad. It is particularly injurious to grass lawns and kitchen gardens. The following method of control, taken from *Circular No. 6* of the Board of Commissioners of Agriculture of Porto Rico, by Crossman and Wolcott is well worth a trial here. It is based on experiments covering a period of several years.

FORMULA.

Thoroughly mix :—

Flour low grade	...	...	...	100 lb.
(1) Paris green	..	...	...	2½ to 3 lb.

The poisoned material is placed in a ring around the plant which it is intended to protect, in a shallow trench about one inch deep and three inches from the plant, using care not to place any closer than three inches or to drop any on the leaves, as it burns the leaf severely. About a heaped teaspoonful is used per plant.

In a vegetable garden the ring method of applying is not so applicable as broadcast distribution. In this case the poisonous bait is scattered over the land, at the rate of 250 to 300 pounds per acre, *i.e.* about an ounce to a square yard. The area treated must be first forked and thoroughly broken up so as to be as free as possible from vegetable matter at the time the mixture is applied. Four or five days should then be allowed before planting to give the mole crickets present ample time to eat the bait and die.

F. W. U.

THE COCONUT BUTTERFLY

Brassolis sophorae.

At the end of 1914 and during the first half of 1915 the coconut butterfly appears to have been numerous. In January an outbreak occurred at Chaguanas on the west coast of Trinidad. In April and May a rather severe attack was reported from the east coast, several thousand tall trees having been affected. As far as our records go, no attacks have taken place on the east coast for years, only one or two trees being stripped of their leaves occasionally. During visits paid to that locality, pupæ collected near the affected trees showed exit holes of parasites. From pupæ collected this year in the central part of the island, a species of *Chalcis* was reared. Eggs found by Mr. P. L. Guppy in the Princes Town district in January and February 1918 were parasitized to the extent of 85 per cent. The Cabbage palms (*Oreodoxa oleracea*) in the Naparima district (south central) seem always to suffer from *Brassolis* and have been so affected as far back as 1908. The southern district was not affected at all.

From British Guiana where this insect is also a pest, Mr. L. D. Cleare reports that the coconut palms in Georgetown suffered from an attack during the past year. It appears as if in both Demerara and Trinidad the parasites were checked by some unusual conditions, possibly the weather.

F. W. U.

(1) When Paris green is not available white arsenic might be substituted.

PARASOL ANTS.

Parasol ants having been proclaimed under the Plant Protection Ordinance, it may be opportune to call attention to the two species concerned. They are *Atta octospinosa* and *Atta cephalotes*. The former takes first place as a pest of gardens about Port-of-Spain and other towns. It also occurs on cacao estates, but its depredations there are insignificant when compared with the larger *Atta cephalotes*, which is the real cacao pest. A peculiarity of *Atta octospinosa* is that it often attacks cacao pods that are ripe, taking off the outer skin.

The control of these pests by carbon bisulphide is well known, and forms part of the routine work of every cacao plantation. There is, however, a time of the year when the nests can be killed to better advantage, namely, just before the swarming of the winged sexes of the ants takes place. *Atta octospinosa* this year swarmed in April and May, whilst *Atta cephalotes* was as late as June and July. The best time for killing nests is therefore during the dry season, say from December to May. The *Mirror* of July 19, reports that thousands upon thousands of males and females of *Atta cephalotes* were seen floating in the sea near Port-of-Spain. The recent heavy rains induced these ants to swarm, and a favourable wind swept them out to sea.

F. W. U.

AGRICULTURAL EDUCATION.

CACAO PRIZE COMPETITION, 1914-15.

Siparia-Erin District.

THE following is the report of the prizes on the Cacao Prize Competition in the Siparia-Erin District for the year 1914-15.

We have the honour to report that judging in the Cacao Prize Competition in the Siparia-Erin District commenced on Thursday July 22 and was concluded on Thursday July 29, during this period twenty competitors' cultivations were visited and judged in the Peñal, Siparia, Quinam, Irois Forest, Chatham, Erin and Fyzabad Districts.

Eleven competitors in each class were originally presented for judging, but two contractors were withdrawn at the last moment, leaving eleven in Class I and nine in Class II to be judged.

After a very careful comparison of the merits of each competitor's work, we are able to recommend that all the prizes in each class, be awarded, to the following twelve competitors whom we adjudge the best in their respective classes.

CLASS I.—PEASANT PROPRIETORS.

Order.	Value of Prize.	Name.	Marks (100).	Nationality.	Acreage.	District.	Ward.
1	80	Lalgee ...	87	Indian ...	5	Irois Forest ...	Erin.
2	60	Lutchman ...	84	„ ...	6	„ ...	„
3	40	Laurence Hilaire	83	Trinidadian ...	7	Quinam ...	Oropuche.
4	30	Mahabir ...	82	Indian ...	6	Chatham ...	Erin.
5	20	Mahabir Goongal	79	„ ...	9	Peñal ..	Oropuche.

CLASS II.—CONTRACTORS.

Order.	Value of Prize.	Name.	Marks (100).	Nationality.	Acreage.	District or Estate.	Ward.
1	60	Hosanee ...	80	Indian ...	3	Sta. Maria ...	Erin.
2	45	Joseph Lilla ...	72	Trinidad—Spaniard ...	8	St. Louise ...	Oropuche.
3	30	Joseph Augustin	71	Trinidadian ...		Eureka ...	„
4	20	Freeling Lewis...	70	Grenadian ...	3	El Perial ...	Erin.
5	15	James Nicholls..	69	„ ...	3½	Sta. Maria ...	„
6	10	Mark Dorset ...	68	Trinidadian ...	9½	La Siparia ...	Oropuche.
7	5	Teekaram ...	61	Indian ...	10	„ ...	„

There is a marked superiority noticeable this year in the work of the peasant proprietors over that of contractors, not only as regards prize winners, but as regards all those judged, the average marks received being for peasant proprietors 76 per cent. and for contractors 68·5 per cent., whilst the prize winners of the former average 83 per cent., and the latter only 70 per cent. of the total number of marks attainable.

The reasons for this result may be briefly summarized as follows:—

- (1.) It is the first competition of the kind ever held in this district, and has been in consequence regarded with a good deal of suspicion.
- (2.) The declaration of war in August last year had a disturbing effect in agricultural circles until the end of the year.
- (3.) Rice planting is a serious competitor of cacao cultivation in this district.

Although all these causes affected both classes alike, a glance at the list of prize winners reveals the significant fact that six out of the twelve prizes have been won by Indians, four of these being proprietors, it would appear therefore that their national characteristics of thrift, obedience and perseverance have enabled them to achieve this very creditable success, which they fully deserve.

A word of praise is due to the prize winners in Class I for their "Tillage," the average percentage of marks being 82·4 per cent., but special mention must be made of Lutchman who gained 90 per cent. by the real intelligence he showed in draining a difficult piece of land, forking all his backward pieces, and applying all his available manure in a thorough manner; an average percentage of 87 per cent. in "General" was also attained by these prize winners, two of whom Lalgee and Mahabir, having gained 90 per cent. under this head.

Full details of the average percentage of marks under each heading will be found in the attached return of competitors judged.

We are of opinion that for a new district the competition has been a success, for we are conscious of the fact that many who entered but never reached judging standard are in reality waiting to see the result; this is especially so amongst contractors, we therefore beg to suggest that it would have an excellent effect on the entries for the next competition if the prize distribution is held in the district itself, either at Siparia or Erin, and is made a function of some importance.

(Sgd.) A. B. CARR.

FERNAND T. FARFAN.

L. A. BRUNTON.

CLASS I—PEASANT PROPRIETOR

Order.	Value of Prize.	Name.	Acreage.	District or Estate.	Ward.	TILLAGE.				SANITATION.				Grand Total.		
						Draining.	Forking.	Manuring.	Systematic.	Total.	Prevention.	Remedial.	Systematic.		Total.	
1	\$90	Lalgee	...	Irois Forest	Erin	18	8	8	9	43	9	8	9	26	18	87
2	60	Lutchman	...	do. ...	do.	18	9	9	9	45	7	8	7	22	17	84
3	40	Lawrence Hilaire	...	Quinam ...	Oropuche	16	8	8	8	40	9	8	9	26	17	83
4	30	Mahabir	...	Chatham	Erin	18	7	7	8	40	8	8	8	24	18	82
5	20	Mahabir Googal...	...	Peñal ...	Oropuche	17	7	6	8	38	8	8	8	24	17	79
6	...	Charles Bristol	...	Los Charos	Erin	15	7	6	7	35	7	8	7	22	17	74
7	...	Mookteeur Maharaj	...	Avocat ...	Oropuche	15	6	7	7	35	7	7	7	21	17	73
8	...	Dookheran	...	do. ...	do.	16	4	3	5	28	9	9	9	27	17	73
9	...	Christopher Sawn	...	Coorampo	do.	17	7	4	7	35	6	8	7	21	14	70
10	...	Amos N. Thomas	...	Siparia ...	do.	15	6	4	6	31	7	7	7	21	15	67
11	...	James Robinson	...	Silver Stream	do.	15	8	5	7	35	6	6	6	18	13	66

AVERAGE PERCENTAGE OF MARKS GAINED BY
Prize-winners.

	All judged.
Tillage	82.4
Sanitation	81.3
General	87.
Total	83.

73.6

76.3

81.8

76

CLASS II.—CONTRACTORS.

Order.	Value of Prize.	Name.	Acreage.	District or Estate.	Ward.	TILLAGE.				SANITATION.				Grand Total.		
						Draining.	Forking.	Manning.	Systematic.	Total.	Preventive.	Remedial.	Systematic.		Total.	
1	£	Hosanee	...	3 Sta. Maria	Erin	17	7	6	7	37	8	10	9	27	16	80
2	60	Joseph Lilla	...	8 St. Louise	Oropuche	16	6	4	7	33	7	8	8	23	16	72
3	45	Joseph Augustin	...	5 Eureka	Do.	17	5	4	6	32	7	8	8	23	16	71
4	30	Freeling Lewis	...	3 El Perial	Erin	15	7	3	6	31	8	9	8	25	14	70
5	20	James Nicholls	...	3½ Sta. Maria	Do.	15	6	5	6	32	8	8	8	24	13	69
6	15	Mark Dorset	...	9½ La Siparia	Oropuche	15	7	6	6	34	7	7	6	20	14	68
7	10	Teekaram	...	10 Do.	Do.	14	5	5	6	30	6	6	6	18	13	61
8	5	Henry Roberts	...	4 Coora	Do.	11	4	3	4	22	4	4	4	12	10	44
9	...	Soobran	...	8 Do.	Do.	9	4	3	4	20	3	3	3	9	8	37

Average percentage of marks gained by
 Prize winners—7. All judged—9.

Tillage	65.4	60.2
Sanitation	76.1	67
General	72.8	63.6
Total	70.1	63.5

PUBLICATIONS RECEIVED.

The Coconut : by E. B. Copeland, pp. XIV and 212. Macmillan & Co., London, 1914. Price 10s.

Prof. Copeland, Dean of the College of Agriculture in the University of the Philippines sets forth in this book the instruction which, supplemented by practical field work, he gives to students in order to qualify them for the practice of coconut raising. The main topics dealt with are the functions of the various parts of the palm, climate, soils, diseases and pests, field culture, seed selection and coconut products. The book is essentially not a compilation of previously available information, but sets forth the fundamental principles of coconut cultivation, as established by prolonged close study of the plant and its requirements. Many vexed questions are clearly discussed in a manner which cannot fail to be both interesting and helpful to the coconut planter who desires to understand the requirements of the plant, and by attending to these, to secure the maximum commercial returns.

Amongst the economic plants of the tropics the coconut is pre-eminently one which gives good returns when grown under favourable conditions. Unfortunately, during these recent years, the high prices for coconut products have tempted many to plant coconuts in places and under conditions far from suitable. The careful study of this book will help to safeguard a prospective planter from similar disastrous experiments. It will also prove of great value and assistance to the planter who has his trees under conditions where they have a reasonable chance of success.

W. G. F.

Le Cocotier. By Paul Hurbert, Pages XIII and 185. H. Dunard, E. Pinat, Paris, Price 5s.

This volume in the useful series of the *Bibliothèque pratique du Colon*, gives a general account of the coconut, its cultivation, diseases, and the preparation of the various products which it yields.

Special attention, accompanied by illustrations, is devoted to machinery for decorticating nuts, extracting oil, preparing desiccated coconuts, coconut fibre, etc.

The Banana, its Cultivation, Distribution and Commercial uses. By W. Fawcett, Pages XII and 287, Duckworth & Co., London, Price 7s. 6d.

The author, Mr. W. Fawcett, is well-known in the West Indies, having been for many years the Director of the Public Gardens and Plantations of Jamaica. The volume contains an account of all phases of banana cultivation and marketing, and diseases and pests are dealt with in considerable detail.

There is also useful information regarding banana flour, preserved bananas and the utilization of bananas as sources of alcohol. About eighty pages are devoted to a general review of banana cultivation in the chief producing countries of the world and the volume concludes with a botanical description of the various species of *Musa*, and receipts for cooking bananas.

The book is the standard one on the banana and should be consulted by all interested in this important plant.

W. G. F.

A Handbook of Tropical Gardening and Planting, by H. F. Macmillan, pp. X and 662. H. W. Cave and Co., Colombo, Ceylon. Second Edition, 1914. Price 14s.

The usefulness of this book is well indicated by the early appearance of an enlarged second edition. The author is the Superintendent of the Royal Botanic Gardens, Ceylon, and although naturally, the volume has special reference to conditions in that colony it will be found of great service to horticulturists in all parts of the tropics.

The following is a brief summary of the scope of the work. Section I. (pp. 1—128) deals with such general topics as climate and soils, cultural operations, manuring, plant propagation, tools, laying out of gardens, etc. Section II (pp. 129—289) treats of tropical and sub-tropical fruits and vegetables, spices and condiments. Section III (pp. 290—468) is devoted to foliage and flowering trees, climbers, shrubs, pot plants, shade and timber trees, plants for cemeteries, railway stations, school gardens and other special conditions. Section IV is more strictly economic, and gives an account of cultivation and preparation of the chief plant products of Ceylon and of various other products from the tropics generally; also briefly of diseases and pests, methods of transporting seeds and plants, and other miscellaneous useful matters.

In the horticultural section of the book, the plants are grouped first according to their suitability for low country conditions in the tropics, or for up-country, *i.e.* more or less sub-tropical conditions. Under each head are given lists of foliage and flowering shrubs, creepers, annuals, bulbous plants, succulents, palms, orchids, grasses, bamboos, etc. suited to these conditions, with descriptive notes, including methods of propagation.

The book is profusely illustrated, largely from photographs by the author, well indexed, and will be found a very useful possession by all interested in tropical horticulture.

Drying Machinery and Practice, by T. G. Marlow, pp. XX and 826. Crosby, Lockwood & Son, London. Price 12/6.

This is a useful reference work which as the author states "is intended to give an insight into the art of drying and descriptions of typical designs of the machines and apparatus used in drying and desiccating. In order to do so the general principles which govern the various methods of removing moisture (water) from all kinds of materials have been briefly stated, followed by a summary of the several methods employed, together with the tables, of calculations necessary in reading the requisite capacities. Then the apparatus, machinery, and installation of plant are described and illustrated by modern typical examples."

There is a very full bibliography of the subject and also a lengthy glossary of technical terms.

The work is well worth consulting by any one concerned in the drying of almost any class of product.

W. G. F.

Bone Products and Manures. By Thomas Lambert, p. 160.
—Scott, Greenwood and Sons, London, 1914, 7s. 6d.

This little monograph should be of interest to all agriculturists. Its author writes with a first hand acquaintance with the manufacture of bone products and manures and the valuation of a great variety of every type of manure now on the market.

Part (1) deals with the manufacture of bone products (bone fat, bone meal, bone charcoal, spent char super-phosphate, marrow fat, glue, size, gelatine, etc.) Part (2)—of equal length—gives first a brief review of the requirements demanded of the soil by plant life and then treats briefly, but very fully, of the different classes of manure and of numerous varieties of each class.

The origin, manufacture, chemistry, comparative value and special value of each manure is considered and particulars are given of special mixed manures, such as those prepared for grass lands, for tobacco and for sugar cane.

The third part is a short chapter of eighteen pages dealing with the methods of analysis of raw and finished products.

The book contains useful drawings of the most modern type of manufacturing plant, and analyses illustrative of most of the products and manures mentioned.

H. S. S.

Mendel's Principles of Heredity; By W. Bateson, F.R.S., pp. XIV and 413. The University Press, Cambridge, 1913. Price 12s. net.

Professor Bateson is the Director of the John Innes Horticultural Institution recently founded in England for the study of the laws regulating plant and animal breeding. "The object of the book is" he states "to give a succinct account of discoveries in regard to heredity made by the application of Mendel's method of research." The subject is treated very comprehensively and the interest of the work is enhanced by the beautiful series of plates in colour which illustrate it.

Appended to the volume are a biographical notice of Mendel and translations of two of his more important papers, which after remaining unnoticed for so many years, were, on their re-discovery, of such value in directing the study of heredity along fresh lines. "Had Mendel's work come into the hands of Darwin, it is not too much to say that the history of the development of evolutionary philosophy would have been very different from that which we have witnessed."

W. G. F.

Illustrated Guide to the Royal Botanic Gardens, Peradeniya. By H. F. Macmillan, p. 43.—Platé & Co.—Colombo, Ceylon. Second Edition—Price—2s.

This guide book will be of interest to others than those who are able to visit the famous gardens at Peradeniya, Ceylon, owing to the large number of good illustrations which it contains and the notes on plants, many of which are known throughout the tropics. Interesting features of the Peradeniya gardens are the fine palm avenues, particularly that of the Talipot palm (*corypha umbraculifera*). The effect of this tree in an avenue may be gauged by inspecting the two large specimens in our gardens, and the front area, to the west of Government House. There is a good index to the plants mentioned.

W. G. F.

SANITATION.

HOUSE FLIES.

How to deal with the House Fly Danger.

With the advent of the rains conditions are suitable for the breeding of house flies and in many localities in this Colony they abound in great numbers. The following *Circular* issued by Dr. C. Gordon Hewitt, Dominion Entomologist of the Department of Agriculture, Canada, will be of interest to agriculturists and others.

House flies are now recognised as *most serious carriers of the germs of certain diseases* such as typhoid fever, tuberculosis, infantile diarrhœa, etc.

They infect themselves in filth and decaying substances, and by carrying the germs on their legs and bodies and in their intestines they pollute food, especially milk, with the germs of the above and other diseases and of decay.

EVERY FLY CARRIES GERMS.

A single fly may carry as many as 500 million germs upon and inside its body.

THE BEST METHOD IS TO PREVENT THEIR BREEDING.

House flies breed in decaying or decomposing vegetable and animal matter and in excrement. *They breed chiefly in stable refuse.* In cities this should be *regularly removed within six days* in the summer. Farm yard manure should be regularly removed within the same time and either spread on the fields or stored at a distance of not less than a quarter of a mile, the further the better, from a house or dwelling.

Manure piles may be treated with borax, using six-tenths of a pound to every eight bushels or ten cubic feet of manure. Scatter the dry borax principally around the sides and edges of the pile and wash in with water.

House flies breed in such decaying and fermenting matter as kitchen refuse and garbage. Garbage receptacles should be kept tightly covered.

All such refuse should be burnt or buried within a few days but at once if possible. No refuse should be left exposed. If it cannot be disposed of at once it should be sprinkled with borax, as above, or with chloride of lime.

FLIES IN HOUSES.

Windows and doors should be properly screened, especially those of the dining room and kitchen. Milk and other food should be screened in the summer by covering it with muslin; fruit should be covered also.

Where they are used, especially in public places as hotels, etc., *spittoons should be kept clean*, as there is a very grave danger of flies carrying the germs of consumption from unclean spittoons.

Flies should not be allowed to have access to the *sick room*, especially in the case of infectious diseases.

Babies should be carefully screened with muslin or mosquito netting.

TO KILL FLIES IN HOUSES.

Mix two table spoonfulls (one ounce) of 40 per cent. formalin, (a solution which may be obtained from any drug store at about 40 cents* per pound bottle), with one pint (sixteen ounces) of equal parts of milk and water. This mixture should be exposed in shallow plates, and a piece of bread placed in the middle of each plate will enable the flies to alight and feed. All dead flies should be swept up and burnt. The burning of pyrethrum in a room, preferably at night, is sometimes effective; the flies should be swept up and burnt as many are only stupefied by this substance.

House flies indicate the presence of filth in the neighbourhood or insanitary conditions.

* In Trinidad the price is about 60c. per lb.

METEOROLOGY.

RAINFALL RETURN FOR JULY, 1915.

Stations.	July, 1915.	July, 1914.	JAN. TO JULY.	
			1915.	1914.
<i>North-west District.</i>				
	Ins.	Ins.	Ins.	Ins.
St. Clair—Royal Botanic Gardens ...	12·76	5·05	27·06	17·84
Port-of-Spain—Colonial Hospital ...	9·01	4·49	20·52	15·52
" Royal Gaol ...	10·58	4·87	24·71	16·22
" Constabulary Hdqrs. ...	7·35	4·46	19·99	17·06
St. Ann's—Reservoir ...	14·72	7·38	32·49	19·59
Maraval—	11·87	5·87	32·36	20·26
" Constabulary Station ...	15·04	7·79	38·49	23·00
Diego Martin—Constabulary Station...	12·92	6·93	37·06	21·58
" Waterworks ...	12·81	8·29	32·30	22·23
" River estate ...	13·47	8·84	33·33	22·90
Fort George Signal Station ...	12·34	5·44	28·47	20·43
North Post ...	11·65	8·54	26·84	20·43
Carenage Constabulary Station ...	15·12	6·98	37·19	27·66
Carrera Island Convict Depôt ...	10·22	5·07	20·92	17·03
Chacachacare Lighthouse ...	6·80	4·25	22·88	18·41
<i>Santa Cruz--Maracas District.</i>				
Santa Cruz—Constabulary Station ...	13·23	10·13	33·76	25·22
St. Joseph—Government Farm ...	12·76	4·00	31·44	18·85
" Constabulary Station ...	7·56	3·94	21·21	16·96
Tunapuna—St. Augustine estate ...	9·46	3·58	29·30	17·80
Maracas—Government School ...	11·70	4·37	28·62	20·19
" Ortinola estate ..	11·18	4·51	31·07	20·75
Caura—Wardour estate ...	10·36	4·73	25·33	18·99
<i>West Central District.</i>				
Caroni—Frederick estate ...	11·80	10·16	37·55	50·03
Chaguanas—Constabulary Station ...	12·35	1·70	32·45	18·35
" Woodford Lodge estate ...	12·47	3·28	32·84	20·49
Carapichaima—Waterloo estate ...	12·29	3·31	29·01	20·01
" Friendship Hall estate ...	14·27	2·90	33·67	21·57
Conva—Exchange estate ...	11·81	5·90	30·05	17·21
" Brechin Castle estate ...	11·01	5·00	30·93	20·01
" Perseverance ...	11·48	6·71	26·68	23·03
" Camden ...	10·02	4·09	28·37	15·98
" Milton ...	11·63	3·94	34·77	18·17
" Spring ...	11·39	4·17	34·36	19·46
" Constabulary Station ...	11·78	4·26	29·38	19·58
" Esperanza estate, Savanetta...	9·71	4·96	30·70	17·59
<i>Montserrat District.</i>				
Montserrat Constabulary Station ...	9·02	3·87	33·85	20·50
Brasso—La Vega estate ...	13·50	4·54	44·91	26·03
<i>Arima District.</i>				
Arima—Warden's Office ...	7·69	2·35	27·39	19·56
" Torrecilla estate ...	15·14	4·94	43·58	31·40
" Verdant Vale estate ...	16·07	6·34	37·23	30·23
San Rafael—Constabulary Station ...	17·10	4·58	51·56	33·94
Guanapo—Talparo estate ...	15·91	4·18	50·31	28·08
" San José Estate ...	15·07	...	51·27	...
Tamana—Sta. Marta estate ...	15·03	5·63	50·90	36·37
<i>San Fernando & Princes Town District.</i>				
Claxton's Bay—Forres Park estate ...	7·97	3·08	29·20	13·97
Pointe-à-Pierre—Bonne Aventure est. ...	9·56	5·12	32·96	21·27
" Concord estate ...	10·30	5·12	37·27	21·96
" Plein Palais estate ...	9·13	4·02	29·30	16·31
Naparima—Picton estate ...	13·63	5·39	34·39	17·66
" Usine St. Madeleine estate ...	11·96	5·99	34·00	20·89
" La Fortunée estate ...	11·60	6·45	28·73	18·01

RAINFALL RETURN FOR JULY, 1915.—CONTD.

Stations.	July, 1915.	July, 1914.	JANY. TO JULY.	
			1915.	1914.
<i>San Fernando and Princes Town District.—(Cont'd.)</i>	Ins.	Ins.	Ins.	Ins.
Naparima—Lewisville ...	11.48	6.50	36.74	22.97
Tarouba estate ...	8.93	4.94	26.65	14.28
Union Hall ...	10.76	6.04	27.24	19.41
Palmiste ...	14.34	6.03	36.10	19.94
Hermitage ...	12.23	5.97	31.06	19.56
Princes Town—Craignish ...	12.32	7.19	36.23	27.22
Cedar Hill estate ...	11.70	6.52	34.30	24.61
Williamsville estate ...	12.41	7.70	35.80	25.67
Esmeralda Estate ...	11.12	6.62	36.68	25.54
New Grant estate ...	13.45	8.05	46.15	39.55
Constabulary Station ...	5.53	4.33	24.81	16.17
Hindustan estate ...	12.82	7.01	41.16	26.79
La Retraite estate ...	15.54	7.77	54.20	40.12
Malgretoute estate ...	8.47	6.42	33.64	25.04
Savana Grande—Friendship & Ben Lomond estates	9.43	5.46	32.88	21.15
Poole—El Rosario estate ...	12.99	7.09	52.22	34.02
<i>South-west District.</i>				
Oropuche—Constabulary Station ...	15.75	8.83	37.79	28.86
Pluck estate ...	14.33	6.50	34.34	19.80
Siparia—Constabulary Station ...	13.69	12.23	44.40	33.22
Alta Gracia estate ...	10.36	...	33.19	...
Guapo—Adventure estate ...	15.70	7.62	33.34	23.47
Cap-de-Ville—Constabulary Station ...	18.34	15.05	39.60	37.76
Erin—La Ressource estate ...	7.26	8.01	29.41	27.28
Industry estate ...	9.71	9.16	29.35	30.78
Cedros—La Retraite estate ...	9.54	...	30.14	...
Constabulary Station ...	9.19	6.91	26.51	25.52
Beaulieu estate ...	8.76	...	...	...
Perseverance estate ...	9.40	6.71	27.07	23.16
St Marie estate ...	8.31	...	24.19	...
Icacos—Constance estate ...	6.80	6.96	24.57	17.15
Irois—Irois estate ...	9.90	11.64	31.24	32.92
<i>South Coast.</i>				
Moruga—Constabulary Station ...	15.58	7.94	38.80	22.38
<i>East Coast.</i>				
Matura—La Juanita estate ...	16.40	7.00	48.58	32.25
Manzanilla—Constabulary Station ...	8.96	6.21	48.42	31.07
Sengre Grande—New Lands estate ...	14.94	5.70	51.66	32.42
Evasdale estate ...	14.36	6.02	52.22	36.85
Grosvenor estate ...	14.21	6.21	56.09	33.03
San Hilario ...	13.65	...	...	...
Mayaro—Constabulary Station ...	12.68	4.90	41.62	22.23
<i>North Coast.</i>				
Blanchisseuse—Constabulary Station ...	11.58	8.61	32.99	30.01
Grande Rivière—Mon Plaisir estate ...	15.80	8.45	46.67	37.15
Toco—Aragua House ...	14.25	5.62	42.06	26.98
Constabulary Station ...	12.19	5.53	36.95	25.48
Point Galera—Light House ...	11.46	4.29	28.27	14.76
<i>Tobago.</i>				
Tobago—Hermitage estate ...	17.78	7.54	39.79	28.02
Riversdale ...	12.14	4.89	29.90	15.95
King's Bay ...	13.74	6.48	38.80	25.28
Roxburgh ...	17.86	7.58	46.57	30.82
Lure estate ...	18.99	8.22	43.47	34.06
Botanic Station ...	13.78	6.57	34.11	20.94
Government Farm ...	10.14	4.19	21.93	10.64
Lowlands estate ...	12.49	4.90	29.74	15.42
Friendship estate ...	14.20	5.23	32.28	18.52
Bon Accord estate ...	14.25	...	28.81	...

NOTES.

Mr. W. G. Freeman, Assistant Director of Agriculture and Government Botanist, sailed for Canada on September 5, on three months leave.

The Board of Agriculture on the invitation of the 'Tobago Planters' Association, paid a visit to Tobago, between August 30 and September 4. Using the R.M.S. *Barima* as headquarters, the party made the tour of the island, and visited representative cacao and coconut estates, the Botanic Station, etc. A joint meeting with the Tobago Planters' Association was also held at Scarborough. An account of the proceedings will appear in a subsequent issue.

The United States Department of Agriculture publishes periodically an *Inventory of Seeds and Plants Imported*. The last list received No. 88 contains a plate of the "Divine" Mango in fruit at the Plant Introduction Station, Miami, Florida. The plant was received from Trinidad in 1907. It is reported to have proved to be of vigorous growth, and fruited for the first time in 1914.

The same publication records the receipt of cuttings, for use as bud wood, of fifteen varieties which were sent from Trinidad by the Department in 1912.

The following notice appeared in the *Royal Gazette* of 16th September, 1915 :—

GOVERNMENT HOUSE,
9th September, 1915.

His Excellency the Governor has been pleased to make the following appointments under the Plant Protection Ordinance :—

Mr. W. E. Broadway, to act as Chief Inspector during the absence on leave of Mr. W. G. Freeman.

Mr. L. A. Brunton to be an Inspector.

Messrs. J. C. Augustus, D. C. Plummer and V. A. Renwick having relinquished their appointments in the Government Service, the appointments formerly held by them under the Ordinance have terminated.

By Command,

S. W. KNAGGS,
Colonial Secretary.

Mr. F. D. Davies, Agricultural Instructor under the Board of Agriculture, arrived in Tobago on the 15th September and began his duties in the Island Ward.

BULLETIN


OF THE
DEPARTMENT OF AGRICULTURE,
Trinidad and Tobago.

PART 6.]

1915.

[VOL. XIV.

VISIT OF THE BOARD OF AGRICULTURE TO TOBAGO.

 ON the invitation of the Tobago Planters' Association, the Board of Agriculture paid a visit to Tobago between August 30 and September 4, 1915.

The party was made up of the following members of the Board:—Professor Carmody, Sir Townsend Fenwick, Messrs. Wm. Greig, J. W. Arbuckle, A. B. Carr, P. I. Cox, J. J. McLeod, C. S. Rogers and Messrs. Devenish, Urich and Rorer Officers of the Board. As Mr. Freeman was unable to make the trip, Mr. W. E. Broadway, Horticulturist and Assistant Botanist of the Department of Agriculture, was invited to join the party on account of his knowledge of Tobago.

The following gentlemen took the opportunity of making the trip: Messrs. Edgar Tripp, Secretary of the Agricultural Society, George Brown, Arthur Greig, W. Goodwin, W. Gordon Gordon, A. H. Cipriani and Captain Gooden-Chisholm.

Mr. Orde, President, Mr. Pitcairn, Secretary, Captain Short and Messrs. Hamilton, Meaden, Grey, Shaw, Harries and Kernahan of the Tobago Association joined the party at various points in Tobago, and made the trip round that Island.

The party left Port-of-Spain on Monday evening, August 30 at a little after seven o'clock, on the Royal Mail Coastal Steamer "Barima," and reached Scarborough early Tuesday morning, where it was met by Mr. J. W. Pitcairn, Secretary of the Tobago Planters' Association, Captain Short, Messrs. H. Hamilton, G. Grey and H. Meaden. Several hours were spent in the Botanic Gardens under the guidance of Mr. Meaden. Everyone was impressed, not only with the natural beauty of the gardens, situated as they are on rolling hills, but also with their neatness and the great variety of plants they contain. Budded mango and orange trees were abundant and much of the land at the back of the gardens has been planted in ground provisions since the outbreak of the war, and this opportunity has been taken to bring together the different varieties of sweet potatoes, cassava, &c., generally cultivated in Tobago, so that a comparison of the value of each may be made. The cacao trees without shade seemed vigorous and healthy, but had not put on much fruit. A beautiful view over the gardens and part of the harbour was obtained from the Curator's house, which has now been made a Rest House. One or two members of the Board bought some plants from the Nursery to take back to Trinidad as souvenirs of the occasion.

Leaving Scarborough at about noon, the "Barima" proceeded to Roxborough, stopping at Hillsborough and Pembroke. Despite a heavy rainfall during the night, and the prospects of a rainy day, many members of the

party went ashore at Roxborough early Wednesday morning and spent about four hours walking through the cacao on Roxborough flat, under the guidance of Mr. R. B. Archibald. Mr. Archibald is carrying out a number of experiments which were of great interest. In one field he has planted cacao 9 x 9 with the intention of cutting out every other tree later on. The trees which will be the permanent ones, 18 x 18 feet, have been raised from selected pods from a few old Criollo trees on the estate. The beans of this cacao are quite large and are white or very light purple when cut open. The dried cacao gives a cinnamon coloured break. The intermediate trees, really used as a catch crop, are mostly from selected Forastero seed to give a quick and heavy yield. Farther on was seen a similar field of about seven years old in which the alternate trees had been severely pruned back so that the permanent ones would not be crowded, but all were setting a good crop of fruit. Mr. Archibald states that cacao is the best catch crop that can be grown with cacao. The experiments have not been carried on long enough yet to give definite results, but Mr. Archibald hopes to show that the increased amount of cacao got from the close planting will more than pay for the upkeep and labour in pruning and cutting out the alternate trees, and that eventually he will have a field with the trees eighteen feet apart giving more cacao per acre, than where the trees are planted 12 x 12, as is the ordinary custom. Mr. Archibald is also an advocate of allowing a sucker to grow from the fork of the cacao tree; by so doing the whole trunk of the tree grows much more rapidly and the result is a much larger and higher tree than is usually met with.

Mr. Archibald never breaks his cacao in the fields, but carries the pods out to places along the carting roads. Here large heaps of the broken shells are let rot for a little while, chemical manures are mixed with them and the whole spread broadcast in the fields which are then "vertically forked." A number of the party walked up to Roxborough House, 400 feet above sea level, and were well rewarded for the climb by the magnificent view and refreshments.

From Roxborough, the steamer proceeded in the afternoon to King's Bay, Speyside and Charlotteville. Within the past few years Mr. R. S. Reid has been planting all the exposed hillsides of King's Bay Estate in cedar. The trees are growing very rapidly, and in years to come should be a valuable asset to the estate. Speyside is perhaps the most picturesque bay of Tobago, surrounded as it is by high hills and with Little Tobago at its entrance.

The night was spent in Man-of-War Bay. Anchor was weighed early Thursday morning, and the trip round the Leeward side of the island begun. Stops were made at Parlatuvier, Englishman's Bay, Castara, King Peter's Bay, Plymouth, Mt. Irvine and Milford.

The party went ashore at Mt. Irvine, where traps were provided by the Tobago Planters' Association, and drove to Milford. Ample opportunity was thus afforded for seeing the coconut cultivation of the Sandy Point District as the road passed by Mt. Irvine, Old Grange, Shirvan, Golden Grove, Friendship, Kilgwyn, Bon Accord and Pigeon Point Estates. This whole district has suffered severely during the past three years of abnormally dry weather, as evidenced by the condition of the young trees and lack of crop on the older trees. As a result of the timely rains this year, a marked improvement has already been made in

the appearance of the trees, and with fair seasonal conditions for the next eight or ten years, several millions of nuts annually should be produced.

The steamer was boarded at Milford and anchor was dropped in Scarborough harbour shortly after eight o'clock.

At ten o'clock on Friday morning the members of the Board were invited to attend a meeting of the Tobago Planters' Association at which many Agricultural matters were discussed. Professor Carmody gave a resumé of some of the experiments at River Estate and Messrs. Rorer and Ulrich spoke of the diseases and pests, or rather their absence in Tobago.

After the meeting, the members of the party adjourned to the Union Club where they were the guests of the Association to breakfast. Excellent speeches, appropriate of the occasion, were made by Sir Townsend Penwick, Messrs. Orde, Gordon Gordou, Professor Carmody, Captain Short and Mr. Tripp.

During the afternoon the members of the party were the guests of Mr. Commissioner Strange and Mrs. Strange at Fort House. Dinner was taken on board the steamer and anchor weighed at ten p.m. Port-of-Spain was reached at six a.m. Saturday morning.

During the four days on the boat going round Tobago, the planters of both Islands had ample opportunity of discussing different Agricultural topics, and there is no doubt that much of value was gained on each side, in this informal exchange of views. Many members of the party had not been to Tobago for a long time—ten to twenty years, and they were much impressed by the great improvement of the Island, not only agriculturally, but in all other ways as well. It was felt that so much benefit was got from a trip of of this kind, that the Board should invite some of the Tobago planters to visit Trinidad and make trips to the various parts of the Island.*

Socially, and from the standpoint of pleasure and recreation, the trip was all that could be desired. Tobago is famous for its bathing beaches, and each and everyone was enjoyed to the full extent. In addition, a large canvas swimming bath was put over the side of the steamer at Roxborough and Scarborough for those who did not care to bathe on the beach.

The Agents of the Royal Mail Company in Port-of-Spain and Tobago, the Captain, Officers and crew of the "Barima" gave every assistance possible to make the trip a thoroughly successful one.

At a meeting of the Board of Agriculture held on September 22. a motion was made by Mr. A. B. Carr, seconded by Mr. J. W. Arbuckle and carried unanimously that: A vote of thanks be given to the Tobago Planters' Association for their kind invitation and pleasant and instructive trip, and to the Royal Mail Steam Packet Company for their kind consideration during the trip.

J.B.R.

* At a meeting of the Board of Agriculture held October 13, 1915, a motion by the Vice-President "That it is desirable to invite this year, a certain number of members selected by the Tobago Planters' Association to visit Trinidad and attend a meeting of the Board," was carried and a Committee was appointed to make the necessary arrangements.

CACAO.

CACAO PRIZE COMPETITION.

DISTRIBUTION OF PRIZES AT ERIN.

ON October 9, His Excellency the Governor distributed the prizes won by the peasant proprietors and contractors in the Erin-Siparia district.

The meeting was held in the Erin Court House, and though the attendance was not large, it was gratifying to note that every prize winner was present.

Captain Huff of the s.s. "Belize," Messrs. Sadler and Murray and Captain Hobson, A.D.C., accompanied the Governor, while Professor Carmody (Vice-President), Hon. H. A. Alcazar, Messrs. Forbes-Todd and Carr and Messrs. Rorer, Urich and Devenish of the Board of Agriculture were present.

Professor Carmody, as Chairman of the meeting, briefly outlined the history of the Cacao Prize Competition, and called attention to the fact that the East Indians, though naturally not a cacao growing people, had so profited by the instruction which they had received from the instructor that they were able to carry off a majority of the prizes.

As the prize winners came forward, Mr. Brunton spoke briefly of each one, telling in what particular points they had done the best work.

His Excellency said that he was very glad he was able to distribute these prizes, as it would be his last opportunity of doing so. He said that he was sure a great benefit was being derived from the Prize Competition, and that the agriculture of the peasantry was benefitted thereby. He was glad to see that the East Indians were winning some of the prizes, and he hoped that this would afford a stimulus to the Trinidadians, so that the Competition might be carried on from year to year with a healthy rivalry between the two races.

Professor Carmody announced that the Competition would be held again next year in the same district, so that all those who were not prize winners this year would have an opportunity of again competing, and he also hoped that many who at first had looked upon the Competition with suspicion, would enter their names for next year's test, now when they had seen the prize winners so well repaid for their work.

PLATE 1.



Fig. 1. Bananas after a Locust attack.



Fig. 2.—Bananas defoliated—Gru-gru palm only slightly attacked.

PLATE II.



Fig. 1. --Immortal trees defoliated.



Fig. 2. -- Coconut palms.

PLATE III.



Fig. 1. - Coconut palms.



Fig. 2. - Garden. Beans destroyed, Tomatoes untouched.

PLANT DISEASES AND PESTS.

REPORT ON LOCUSTS IN VENEZUELA.

By W. G. FREEMAN, B.Sc., A.R.C.S., F.L.S.,

Asst. Director of Agriculture.

(With five plates).

IN accordance with instructions from His Excellency the Governor, Mr. A. E. Collens, F.C.S., and myself left Port-of-Spain, in the "Ponemah" on Saturday, May 29, 1915 at 8.25 p.m. and arrived at Cristobal Colon at 8.15 a.m., on the 80th.

Whilst rowing ashore flights of locusts were observed over the summits of the low hills which come close to the shore. On landing, their presence was immediately obvious on the patches of ground covered with various low shrubby weeds, a person or animal passing through raising clouds of the insects.

The locust was recognised as being identical with that forwarded to me from Ciudad Bolivar in January last, by Mr. Robert Henderson, and reported on to the Board of Agriculture by Mr. F. W. Urich, the Entomologist. It has been identified by Mr. J. A. G. Rehn of the Academy of Natural Sciences of Philadelphia as *Schistocerca paranensis* Burmcister, a very destructive pest in South America.

Amongst the weeds the so-called "Negro coffee," (*Cassia occidentalis*) was abundant, and was apparently a favourite food, being eaten whilst adjacent plants were almost untouched. A striking case of the destruction wrought by the locust was seen in a plot of bananas; practically only the midribs of the leaves had been left. Immortel trees, (*Erythrina umbrosa*), were almost completely stripped of leaves; this tree as was seen later is one of which they are very fond.

A coconut plot was next visited. This had attracted attention, whilst we were a considerable distance from land owing to the brown, drought-stricken appearance of the trees, which was found to be largely due to locust attacks, the green parts of the leaves having been eaten leaving little more than the mid-ribs in those badly attacked. Some of the trees were about 40 feet in height, and both young and old leaves had been eaten. Closely adjoining was a garden, which we were informed was recently green with a young growth, chiefly of beans. Now only the short bare stems of the plants were to be seen. Tomato plants scattered here and there through the plot, were however, in full leaf and did not appear to have been touched. Through all this area the soil was of a light sandy character, and swarmed with adult locusts, some of which were seen mating. On bare places devoid, or nearly so, of any vegetation, they were equally numerous, and on these areas they will probably lay their eggs. No hoppers (immature insects) were seen throughout the visit.

Striking next the stream to the south of the town and proceeding up stream, we soon entered some cacao cultivation laid out in very regular lines, and shaded with immortels. The ground was bare of undergrowth, and carpeted with dry leaves. Locust excrement was everywhere on the ground, and was continuously falling with the characteristic sound of a fairly smart shower of rain. This afforded an excellent idea of the number

of locusts at work above. The cacao however may be said to have been untouched with one or two trifling exceptions in open spots. The insects were at work on the immortels, many of which had been partially stripped of leaves, parts of which littered the ground. The one or two exceptional cases referred to show that the locusts will eat the leaves of fully grown cacao, but the instances seen were only in open, almost unshaded spots. Apparently the locusts avoid shaded places, and work on the immortels above the cacao. None were seen on the ground or flying in the cacao, although so numerous on the open ground outside, and on the immortels overhead.

Leaving the cacao at about three quarters of a mile from the shore, a "savannah" was entered. Here a few scattered immortels were all stripped, but trees such as saman (*Pithecolobium saman*), Sandbox (*Hura crepitans*), bois canôt (*Cecropia peltata*) and a species of Mimosa were scarcely if at all touched. Gru-gru palms (*Acrocomia sclerocarpa*) and cabbage palms (*Oreodoxa oleracea*) had been attacked, but not severely.

An interesting case of partiality for certain plants was seen here. A garden had been formed on a plot surrounded by a wide extent of Guinea grass, the beans and corn of the garden had been entirely eaten, but the few fannias present had been left quite untouched as also all the Guinea grass, even including a few small tufts in the garden itself. The ultimate result was a small bare patch in the middle of a large expanse of young green Guinea grass.

From this point we returned to the boat and sailed at 2 p.m. for Guiria, about 20 miles to the south along the coast, which was reached at 6 p.m.

On the following morning we landed and under the guidance of Mr. Kernahan, who is in charge of the British Consulate in the absence of Mr. Permuy, the Vice-Consul, took a walk of some six miles through the surrounding country. The observations made were similar to those at Cristobal Colon. The locusts were present in large numbers, the ground being yellowish-brown with them in favoured open spots. Coconuts, immortels, bananas, corn, cassava, peas, beans, &c., were again seen to be their favourite foods, whilst most of the wild trees, weeds and grass were but little touched.

Figure 2, Plate IV shows the beginning of attack on a patch of coconut and bananas, the younger coconut in this case being practically stripped. The Castor oil bush in the foreground has not been touched.

On a cacao estate visited, the locusts were very numerous in open spots, rising in clouds on being disturbed. The insects settled on and ate the cacao in the drying house, attracted apparently by the mucilage on the beans. The immortels were stripped but cacao and bananas under them untouched. On this estate no sign of damage to cacao was seen; young cultivation with the plants comparatively exposed being untouched.

Another interesting case of preference was seen here. Two kinds of immortels were on the estate, bucare (*Erythrina velutina*) and anauca (*E. umbrosa*). The latter as at Cristobal Colon, was stripped whilst the

PLATE IV.

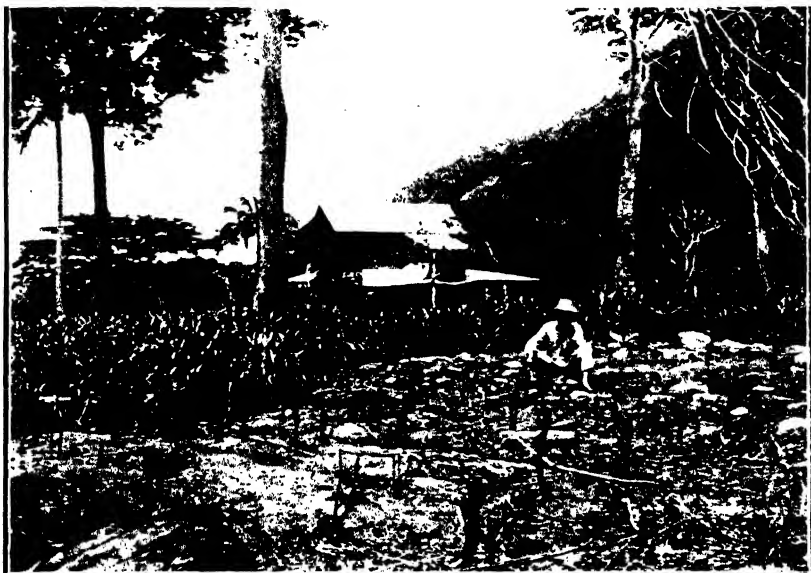


Fig. 1. Vegetable garden. Corn and bean eaten; surrounding Guinea grass not touched.



Fig. 2. --Bananas and coconut palms attacked; Castor oil plant (foreground) untouched.

PLATE V.



Fig. 1. Immortel trees stripped by Locusts.



Fig. 2. Bananas, cacao, &c., under shade not touched. (View beneath Immortel trees shown in fig. 1).

former was not touched. Instances of the two trees, side by side, one in full leaf and the other quite bare, were observed. No sugar cane cultivation was seen, but we were informed that this locust greedily eats cane leaves. This is in accordance with what is known of its habits in other parts of South America.

In addition to the observations we were able to make on land we obtained other information from residents. There was a general agreement that this was the first invasion since 1885, the year when the locusts also reached Trinidad. The present invasion was however as yet not comparable to that of thirty years ago in magnitude. Then as one who witnessed it said, they came in great masses, darkening the sun for two days, and literally covering the earth. Their depredations were so great that the people were reduced to want. Some left for Trinidad, others were forced to eat green pawpaws and old tannia roots; small green bananas sold ten for ten cents, and people sold a donkey to purchase a bag of rice.

Whilst off the Venezuelan Coast on both afternoons numerous flights of locusts were seen over head, travelling mostly in a south-westerly direction, with the wind, at a considerable height, probably about 200 feet or more. Many alighted on the boat, and were caught and brought back to serve as specimens and for experimental purposes.

It was reported that the locusts fly most actively in the afternoon, and that their general movement is easterly or north-easterly, *i.e.* in the direction of Trinidad, but that they are set back by the prevailing north-easterly winds.

Certainly enormous quantities of the locusts were meeting their death in the sea. In places, yellow patches resembling at a distance gulf weed, were seen, and fishermen report large numbers going out through the Bocas in the current. Since my return I have seen them washed ashore in large quantities at Chacachacare, and to a less degree, at Monos, and received reports of their presence on the shore at Gasparee and Iacos. The living insects have also reached Patos, Chacachacare, and a very few, Monos.

It is thus evident that the sea and the contrary winds have up to the present proved very effective obstacles to their invading Trinidad, but a spell of westerly winds would probably bring them over, and even calm weather may prove sufficiently favourable to allow them to make a safe crossing.

There will be thus a constant menace so long as they are abundant in the gulf states of Venezuela, and it would be of practical advantage and of value in connection with any possible outbreak here if the Entomologist could later carry out experiments in locust destruction in Venezuela, *e.g.* by inoculation with bacterial and fungoid diseases, &c., with of course, the permission of the Venezuelan Government. Should the present host be succeeded by a large next generation, they will begin operations much nearer Trinidad, and our chances of escape will be proportionately reduced.

In any case, it would be of great value if His Majesty's Consul at Guiria would be so good as to keep this Government informed of the progress of events.

Information is specially desired as to:—

- (1.) The cessation of flight of the present swarm.
- (2.) The appearance of hoppers from this swarm's eggs.
- (3.) The appearance of fresh swarms of mature flying locusts.

Brief visits of inspection could then be made at any time that circumstances demanded. We left Guiria at 6 p.m. on the 30th and reached Port-of-Spain at 9.45 a.m. on June 1.

We were very much indebted to Dr. Calvani, the Consul for Venezuela at Port-of-Spain, for a letter of introduction to the Collector of Customs at Cristobal Colon, which greatly facilitated our movements. The Venezuelan authorities both military and civil, were most courteous and gave us every assistance. The help afforded by Mr. Kernahan at Guiria has already been referred to.

I beg to suggest that the thanks of the Government be conveyed to Dr. Calvani and to the Government of Venezuela for the courtesies received from its officials.

June 8, 1915.

NOTES ON THE SOUTH AMERICAN MIGRATORY LOCUST (*Schistocerca paranensis*—Burm.).

By F. W. URICH,
Entomologist Board of Agriculture.

IN accordance with a recommendation of the Board of Agriculture which was approved of by His Excellency the Governor, I visited Guiria to study the habits of the young stages of the South American locust. Leaving Port-of-Spain on August 18th, in the "Ponemah," I arrived at Guiria via Cristobal Colon on the 19th. The 20th was spent in the town of Guiria and immediate surroundings, and on the 21st I set out for Chevalier Permuy's Cacao estate at Guaraguara, where I remained until the 24th when I returned to the town and embarked the next afternoon for Port-of-Spain, arriving there early on August 26th.

Thanks are due to Mr. J. M. Rodriguez, Acting Consul for Venezuela, General Olivares, Administrator of Cristobal Colon, Chevalier E. G. Permuy, British Vice-Consul at Guiria and Mr. W. Scott Kernahan, Secretary of the British Consulate at Guiria. Chevalier Permuy's knowledge of local conditions proved most valuable to me and during my stay in Venezuela, I was his guest.

NATURE OF SWARMS.

The swarms which were small and isolated, consisted mostly of hoppers in the last instar, there were a few stragglers of the preceding instar, and I estimated then that the fliers would appear in the first half of September.

HABITS OF THE HOPPERS.

The hoppers like sunshine above all, and are very active while it lasts. In the dense shade of the wild vegetation they climb to the tops of shrubs or trees in search of the sun and then feed on the plants if suitable. In the shade of cacao they congregate in sunny spots, climb cacao, coffee and immortal trees to get into the sunshine. They will ascend immortal trees up to thirty or forty feet and I think they would get at the leaves were there any left. It happened that all the immortal trees in the whole district had been stripped of all leaf by the caterpillar of a pyrale moth of which there was a severe infestation at the time of my visit. When evening is drawing near, the hoppers stop feeding and congregate on the tops of low growing shrubs and trees where they spend the night. When the sun has risen and strikes them, they get on the move, either to finish up the food plants remaining over from the preceding day or to migrate in search of others. The rate of advance varies. In the cacao a swarm was seen to advance about a hundred yards in half an hour, but allowance has to be made for the disturbance caused by my approach. Other swarms kept under observation advanced about three quarters of a mile in a day. In the Guarama district all swarms seems to be going in a westerly direction. The swarms are comparatively small, consisting from a quarter to one million hoppers each. Those of the savannahs or open spots being the most numerous. Feeding is not indulged in all the time, but there appears to be periods of rest when the hoppers bask in the sun. In the cacao, the hoppers climb the banana plants to eat them down, and when young cacao leaves were near, they were also devoured. Coffee leaves are not touched, Guinea grass is eaten but not to any great extent. The hoppers are extremely wary, and on the approach of any man or animal get on the move. A peculiar odour is perceptible wherever a swarm of hoppers occurs; it may be described as that of green vegetation recently cut and in the process of drying and decomposing.

FOOD-PLANTS OF HOPPERS.

After corn, which had been wiped out, banana was the favourite food-plant. Other plants attacked were cacao, balizier (*Heliconia* species), tania, carat palm, gru-gru palm, castor oil plant, large nettle, cassava, Guinea grass, a Piperaceous plant, a species of wild spinach, Acacia, small Anauca immortels, cacao in a slight degree, and when near, banana.

DAMAGE TO VEGETATION.

All along the Coast from Cristobal Colon to Guiria the coconut palms which had been damaged by the flying insects in June, were putting out new fronds, and near the shore there was no damage to the low-growing plants to be seen. About two miles from the shore, wherever adult locusts or hoppers had passed, there was no corn left all had been eaten off to the ground; the other favourite plant appears to be banana, which was everywhere badly damaged. Otherwise the vegetation which is most luxuriant showed little signs of locust damage.

BREEDING GROUNDS.

The dense tropical growth of the country, with the exception of a few comparatively small open savannahs covered with Guinea and other species of grass, has restricted oviposition, and prevented the large hordes of

hoppers that we read of in the plains of the Argentine and of South Africa. Suitable breeding grounds in the districts visited are scattered and small and the result has been that comparatively small isolated swarms of hoppers are distributed all over the country. On a journey from Guiria to the districts of Guarama and Guaraguara a distance of about seven miles from the coast, eight different swarms were seen near the road as follows: *No. 1 Swarm*—About one and a half miles from Guiria in scrub near road, hoppers sunning themselves on the road and feeding on the wild acacia trees about fifteen to twenty feet high. *No. 2 Swarm*—A half mile further, attacking a small plantation of banana, cassava and ground provisions. *No. 3 Swarm*—One and a half miles further in cacao attacking bananas, young anauca immortal and young leaves of the full-grown cacao. *No. 4 Swarm*—A quarter mile further on open savannah, largest swarm seen up to then, attacking acacia trees and low-growing plants. *No. 5 Swarm*—A half mile further on acacia trees and on ground in the grass of the savannah. *No. 6 Swarm*—A half mile further near a cacao estate on the bush, on coffee trees and Guinea grass near the dry bed of a small stream. *No. 7 Swarm*—Near a cacao estate on the cacao trees, bananas, balizier and scrub. *No. 8 Swarm*—Near cacao estate on bank of small running stream, feeding on castor oil plant and cassava. Swarms are also encountered in cacao estates; apparently the hoppers did not hatch there, but migrated from surrounding Guinea grass fields. Under the shade of the cacao trees, eight swarms were seen in the course of walking through three large estates in two days. I assume that the conditions as described above exist right through the Gulf States of Venezuela.

NATURAL ENEMIES.

No natural enemies of any consequence were observed, and the hoppers all look uncommonly well and active. No dead hoppers suffering from any bacterial or fungoid diseases were found, and no parasitic or predaceous flies were seen. Toads were noticed engorging themselves on hoppers, and few birds appeared to pay any attention to them. Poultry, pigs and dogs were seen feeding on hoppers.

SUMMARY OF THE LIFE-HISTORY.

The life-history of this brood of locusts could not be worked out on account of the distance from the breeding grounds, but from information kindly supplied by the British Vice-Consul at Guiria, the following is a fairly accurate period of development in a locality near Guiria;

Fliers swarming and ovipositing	... June 1.
First appearance of hoppers	... June 25.
First appearance of fliers	... August 29.

Total period of development	... 2 months 29 days.
-----------------------------	-----------------------

Fliers have been reported coming from other districts towards Guiria on September 14th and October 11th.

DISTRICT INVADED.

As far as I have been able to ascertain by personal examination and telegraphic enquiries, a great part of the peninsula forming the north-westerly border of the Gulf of Paria was infested by isolated swarms of

hoppers. At the present time all the hoppers have changed to fliers, which are moving about in that part of Venezuela, some going north and others west. No information is at hand of the conditions in the country bordering on the Caribbean Sea.

POSSIBILITIES OF AN INVASION OF TRINIDAD.

So many factors have to be considered in connection with the development of swarms of locusts that it is impossible to say what may happen. The isolated swarms may unite and form a large army, or they may migrate in detachments. As the food supply is abundant, the locusts may not migrate at all for the present. Natural enemies may turn up and reduce the numbers. In connection with the 1885 outbreak, only one migration to Trinidad took place, but the people of Guiria say that after the invasion of 1885 the locusts continued for five years but that they gradually dwindled away and disappeared altogether. All agree that the present invasion is not to be compared with that of 1885, which was by far worse. If that is so, there is a possibility that we may not see anything of this brood in Trinidad. If however, there is to be an invasion, it will take place within the next month or two.

October 15, 1915.

REPORT ON THE INOCULATION OF LOCUSTS WITH *COCCOBACILLUS ACRIDIORUM*.

By JAMES BIRCH RORER,
Mycologist, Board of Agriculture.

LAST June when there was the possibility of a locust invasion of Trinidad from Venezuela, it was deemed advisable to experiment with *Bacillus acridiorum*, an organism discovered by d'Herelle in Yucatan in 1912 and used very successfully in the following years in Argentina as a means of controlling the locust pest.

This organism in its virulent form causes death in from six to eight hours. It causes an acute diarrhœa and the liquid excrement is voided abundantly on the food plants and in this way large epidemics may be started.

Through the kindness of Mr. P. Serre, Consul for France in Trinidad, three small tubes containing the dried bodies of diseased locusts were obtained from the Pasteur Institute. This material was tried, not only on the Venezuelan migratory locust, but also on the native Giant locust. The results of the inoculation are recorded below:—

A small amount of dried bodies of diseased locusts received from the French Consul was macerated in 2 c.c. of sterile water.

September 27, 1915. 2.50 p.m.—Eight healthy specimens of *Schistocerca paranensis* (Venezuelan locust) were inoculated hypodermically, each with a drop of this liquid. Inoculation was done with a very fine needle between the second and third segments of the ventral side of the body. One healthy locust was inoculated with double the amount of the liquid. Seven healthy locusts, to serve as controls, were treated in exactly the same way, except sterile water alone was used in the hypodermic syringe.

September 28. 1.30 p.m. The locust which was inoculated with the double quantity died. All the others were very sluggish in their movements, and were voiding liquid excrement. They all died during the night. All the control locusts were healthy and active.

September 29. 8 a.m. Squeezed out liquid from the abdomens of two dead locusts, diluted with half sterile bouillon and inoculated six fresh locusts, each with one drop of fluid. Examined the fluid under the microscope and it was teeming with bacteria.

September 30. 8 a.m. Four of the locusts of the second series were dead and two were very weak.

September 30. 9 a.m. Inoculated third series of six locusts with the liquid squeezed from the bodies of those of the second series, and mixed with bouillon.

September 30. 1.30 p.m. Two locusts were dead and the others were sluggish and died during the afternoon.

This series of inoculation shows that the virulence of this organism can be increased for the Venezuelan locust, in a way similar to that used in Yucatan and Argentina.

A similar series of experiments was tried, using the Giant locust from Cedros *Tropidacris dux*, which were kindly sent to me by Mr. Urich.

September 30. 2.45 p.m. Six locusts were inoculated with liquid similar to that used for the first series of the Venezuelan locusts. As this locust is quite large, two drops of liquid were used for each inoculation.

October 1. 8 a.m. One locust was dead, and all the others were very sluggish and showed characteristic symptoms of the disease. All, but one, were dead at midday.

October 1. 8.30 p.m. The second series of six locusts were inoculated from the material squeezed out from the abdomens of two of the dying locusts of the first series.

October 1. 1.30 p.m. One was dead, and the others showed symptoms of the disease.

This experiment shows that the organism is virulent also for the Giant Trinidad locust. Pure cultures have been made of the organism, and will be sealed up and kept for use in the future, if occasion should ever arise. Some of the bodies of the dead locusts also will be dried and ground, and kept on hand.

Mr. Urich has had some recent reports from Venezuela, stating that the locust there are migrating inland, so that we shall probably not be invaded this year; but if at any time large numbers of hoppers should be reported along the Venezuelan coast it would be advisable to try the efficacy of the bacterial disease as a means of control. Mr. Urich has just returned from Cedros, and says that the Giant locusts are quite scattered there, and will probably not get into the cultivated areas. However, next year when the young hoppers begin to hatch out in that district, it will be well worth while spraying their favourite food-plants with cultures of the bacillus.

THE MANURIAL VALUE OF LOCUSTS.

If the locusts should come to Trinidad in large swarms Planters should not lose the opportunity of collecting them and using them as a manure. Their bodies are particularly rich in Nitrogen—the most expensive ingredient in a manure.

The following analyses of the large locusts found frequently in the Cedros district and of the Venezuelan locusts have been made at the Government Laboratory by Mr. A. E. Collens and are published for general information:—

CEDROS LOCUSTS (*Tropidacris dur*).

		<i>Recently killed. Air dried.</i>	<i>Dry.</i>
Water	...	70·39	11·64
* Organic	...	28·57	85·22
† Ash	...	1·04	3·14
		<hr/> 100·00	<hr/> 100·00

Containing:

* Ether extractive fat waxes, etc.	...	2·90 %	8·65 %	9·80 %
* Nitrogen	...	3·34 %	9·98 %	11·30 %
† Potash (K_2O)	...	0·34 %	0·94 %	1·16 %
Phosphoric anhydride (P_2O_5)	...	0·48 %	1·44 %	1·63 %

Approximate value, fresh = \$12.00 per ton.

„ „ Air dried = \$86.00 per ton.

with nitrogen at 15 cents per lb.; potash and phosphoric anhydride 5 cents each per pound.

VENEZUELAN LOCUSTS (*Schistocerca paranensis*).

		<i>Fresh state.</i>	<i>Air dried.</i>	<i>Dry.</i>
Water	...	56·34	9·76	—
* Organic	...	42·11	87·04	96·45
† Ash	...	1·55	3·20	3·55
		<hr/> 100·00	<hr/> 100·00	<hr/> 100·00

Containing:

* Nitrogen...	...	5·31 %	10·99 %	12·18 %
† Potash	...	0·41 %	0·85 %	0·94 %
† Phosphoric acid (P_2O_5)	...	0·68 %	1·80 %	1·44 %

(Sgd.) A. E. COLLENS, F.C.S.,
Assistant Analyst.

INSECTS AFFECTING THE COCONUT PALM
IN TRINIDAD.

By F. W. URICH,
Entomologist, Board of Agriculture.

BEETLES.

(1.) *Rhynchophorus palmarum*, L.

Common name—Gru-gru Beetle.

Natural enemies—The larvæ are preyed upon by the larvæ of an Elaterid and Histerid generally found associated with them in palms attacked.

Status—The Gru-gru beetle does not attack sound Coconut palms. It is attracted to trees that have been wounded or to those suffering from fungoid or bacterial disease.

Control—The control measures are obvious. Avoid wounding trees when picking, and if by accident this happens, apply tar or crude oil to the cut. Young fronds damaged by other fronds falling on them from taller trees should be cut off and tarred. Burn all parts of the plant felled for disease, as they offer suitable breeding places.

A full description and life history of the beetle and methods of control will be found in Circular of the Board of Agriculture No. 5, pages 7-11.

(2.) *Rhina barbirostris*, L.

Common name—The bearded weevil.

Natural enemies—Larvæ of an Elaterid prey on the larvæ in their burrows, especially when the palms are on the ground. An undetermined Tachina fly has been reared from larvæ.

Status—The bearded weevil does not attack perfectly sound palms, but is attracted to those suffering from fungoid or bacterial disease and to palms, the bark of which has been scorched by fire.

Control—Palms that have been burnt should have the charred parts cut out, and should then be treated by an application of crude oil, tar or a stiff paste of white lime to which is added arsenate of lead paste in the proportion of 5 lb. to every 50 gallons, of lime. The so-called flaming of Coconut palms for disease should be discontinued. For further information see Circular Board of Agriculture No. 5 pages 14-16.

(3.) *Metamasius hemipterus*, L.

Determined by Imperial Bureau of Entomology.

Common name—The small weevil borer.

Natural enemies—The same as the Gru-gru beetle.

Status—A secondary pest generally found associated with the Gru-gru beetle, but also attacking palms that have been wounded or are suffering from disease.

Control—Destroy all possible breeding material by burning, and apply crude oil or tar to any wounds. See Board of Agriculture Circular No. 5, page 12.

(4.) *Metamasius obsoletus*, Gyl.

Determined by Imperial Bureau of Entomology.

Common name—The small weevil borer.

Status and control—The same as No. 3.

(5.) *Xyleborus affinis*, Eich.(6.) *Xyleborus confusus*, Eich.

Determined by Col. Winn Sampson through Imperial Bureau of Entomology.

Common name—Shot hole borers.

Status—Secondary pests attacking trees affected by fungoid or bacterial disease. They are also attracted to trees that have been scorched.

Control—Avoid scorching trees and if they be burnt accidentally, cut off bark and apply crude oil or tar.

(7.) *Strategus alocus*, L.

Determined by Imperial Bureau of Entomology.

Common name—Rhinoceros beetle.

Natural enemies—The larvæ are affected by the Green muscardine fungus and a species of *Cordyceps*.

Status—The adult beetle attacks young Coconut palms by burrowing down into the earth near the plant and ascending into the bud from beneath.

Control—Larvæ breed in rotting stems of Coconut palms and trees, so avoid these by burning or removal. The entrance to the burrows of beetles is visible near the plant and the beetles can be dug out and destroyed. They will be found about 18 inches below the surface. See Board of Agriculture Circular No. 5, page 23.

(8.) *Enema endymion*, Chev.

Determined by Imperial Bureau of Entomology.

Common name—Rhinoceros beetle.

Status and control—Same as for No. 7 as far adults are concerned. The larvæ live in the ground on decomposing vegetable matter.

(9.) *Phileurus didymus*, L.(10.) *Passalus interruptus*, L.(11.) *Scalpus interstitialis*, Eich.

Determined by Imperial Bureau of Entomology.

Common name—Scavenger beetles.

Status—Not to be classed as pests, but often mistaken as such. The larvæ and adults live in rotting stems of palms and trees lying on the ground.

CATERPILLARS.

(12.) *Brassolis sophoræ*, L.

Common name—The Coconut butterfly.

Natural enemies—The eggs are attacked by an undetermined parasite, the larvæ are destroyed by *Tachina* flies and the pupæ are affected by a Chalcid.

Status—The coconut butterfly can become a serious pest when not kept in check by natural enemies.

Control—Cut down and burn nests of caterpillars and when practicable, spray with arsenate of lead in the proportion of 4 lb. to 50 gallons water. See Board of Agriculture Circular No. 5, page 19.

(13.) *Castnia licus*, Drury.

Common name—Giant moth borer.

Natural enemies—The Kiskadee attacks the adult moths.

Status—The caterpillar attacks young coconut plants by eating the soft tissues of the developing fronds and if left too long destroys bud.

Control—The leaves of the frond attacked generally turns yellow and the caterpillar which will usually be found at the base of the frond can be cut out and the wound tarred, or treated with crude oil.

(14.) *Sibina modesta*, Cram.

Determined by Imperial Bureau of Entomology.

(15.) *Automeris liberia*, Cram.

Determined by Dr. H. G. Dyar.

(16.) *Hesperus* sp.

Status—The caterpillars of the above occur occasionally on Coconut palms but they are not serious pests and are kept in check by natural enemies.

(17.) *Tortrix* sp.

Status—Not a pest. The caterpillars join leaves of the fronds together by means of silken threads in which they live, eating off the leaf tissue.

SCALE INSECTS.

(18.) *Aspidiotus destructor*, Sign.

Common name—The Coconut scale.

Natural enemies—The scales are attacked by an internal hymenopterous parasite. The Coccinellidæ *Azya trinitatis*, Marshall and *Cryptognatha nodiceps*, Marshall are efficient predators.

Status—On tall full-grown palms and when associated with the ants *Astea charitifer*, this scale can be quite injurious, and if neglected, will slowly but surely cause the death of the palm. On young trees the scales are destroyed by the Coccinellids mentioned above.

Control—The ants have the habit of making their nests in cutlass cuts on the stems of the palms. These should be cut out and painted with crude oil or tar. The scales can then be sprayed with any good insecticide. Commercial lime sulphur yields good results. See Circular Board of Agriculture No. 5, page 17,

(19.) *Icerya montserratensis*, Riley and Howard.

The Montserrat Fluted scale.

(20.) *Vinsonia stellifera*, Westw.

The Star scale.

(21.) *Pinnaspis buxi*, Bouche.

The long scale.

Status—The scale insects always occur on the Coconut leaves but are never numerous enough to do any damage.

(22.) *Pseudococcus nipa*, Mask.

Common name—The Yellow mealy bug.

Status—On full-grown palms the yellow mealy bug does not appear to do any damage, lately, however, several young palms, showing aborted centre shoots always contained these mealy bugs associated with ants *Campanotus* sp., in a small cavity near the growing tip.

Control—Cut off the aborted fronds, clean out cavity and apply tar or crude oil.

WHITE FLIES.

(23.) *Dialeurodicus pulcherrimus*, Quaint and Baker.

(24.) *Dialeurodicus* sp.

(25.) *Aleurodicus cocois*, Curtis.

(26.) *Aleurodicus trinidadensis*, Quaint and Baker.

(27.) *Aleyrodes* sp.

(28.) *Paraleyrodes* sp.

All above determined by Dr. A. L. Quaintance.

Common name—White flies.

Status—White flies do not occur in sufficient numbers to be classed as pests.

THRIPS.

(29.) *Heliothrips hæmorrhoidalis*, Bouché.

Determined by Mr. R. S. Bagnall.

Status—Of no economic importance, but occasionally found on the leaves.

ANTS.

(30.) *Atta cephalotes*, L.

(31.) *Atta octospinosa*, Gunther.

Common name—Parasol ants.

Status—*Atta cephalotes* occasionally strips young plants of leaves. *Atta octospinosa* will ascend the palms and remove the male flowers.

Control—Kill nests with Carbon bi-sulphide.

TERMITES.

(32.) *Entermes* sp.

(33.) *Calotermes* sp.

Common name—White ants.

Status—Termites generally attach their nests to different parts of the palms. When the bark is off and any part of the trunk is decayed, they make their nests there, and breed on the dead tissues.

Control—Palms should be freed of nests at regular intervals, and the nests destroyed by burning.

GRASSHOPPERS.

(34.) *Tropidacris dux*, L.

Common name—Giant grasshopper.

Status—Occasionally this grasshopper has been known to damage coconut palms, but attacks of any consequence are few and far between.

Control—The best way of dealing with this pest is to destroy the young hoppers as they hatch at the opening of the rainy season, by driving them into trenches or surrounding and burning them.

CEDAR LOGS.

(Read at a Meeting of the Board of Agriculture, 13th October, 1915.)

Herein the details of the cost of delivering in Port-of-Spain cedar logs from trees taken from Crown Lands bordering on the Southern Cunapo Road, about 12 miles from Sangre Grande, which I undertook to submit for the information of the Board.

The trees were purchased at the usual price of \$1.00 per foot of girth taken at 8 feet from the ground.

A. 3 Trees at above mentioned price	...	\$ 70.00
Felling and sawing	...	63.00
Transporting to Cart Road	...	90.00
Cartage to Sangre Grande	...	90.00
Railage to Port-of-Spain, 4 truck loads at \$7.44 (a truck carries about 220 c. ft.)	...	29.76
		<hr/> \$842.76

These trees gave 900 c. ft. of logs—cost per c. ft. 38 cents.

B. 3 Trees (same price)	...	\$ 46.00
Felling and sawing	...	36.54
Transporting to Cart Road	...	52.20
Cartage to Sangre Grande	...	52.20
Railage to Port-of-Spain (3 trucks at \$7.44)	...	22.32
		<hr/> \$209.26

These trees gave 522 c. ft. of logs—cost per c. ft. 40 cents.

There is no safe guide or rule as to the number of cubic feet which will be obtained from a tree of a given girth—the shapes of the trees, the extent of the buttresses, and possible flaws in the hearts, varying the results considerably.

I think 40 cents per cubic foot a safe figure on which to estimate. The distance from town, the accessibility in the forests, and convenience of transport fairly represent the conditions in most parts of the Colony where cedar is plentiful.

To place boards on the local market for building purposes 9.2 per cubic foot must be added for saw-mill expenses and cartage from railway station, making the total cost 49.2 cents per cubic foot or 4.1 cents per foot lumber measure—say per 1,000 feet \$41.00.

This compares very favourably with prices of American and Canadian lumber; but it is a moot question whether any large orders could be expeditiously filled.

I am,

Yours faithfully,

G. TOWNSEND FENWICK.

AGRICULTURAL PROGRESS IN TOBAGO.

By P. CARMODY,
Director of Agriculture.

(Read at a Meeting of the Planters Association Tobago, 3rd Sept., 1915.)

The agricultural progress of Tobago in recent years is very strikingly shown in the official statistics of exports, and as these are probably not so familiar to others as they are to you I have collected the most important and classified them under the following heads:—

- I Sugar, Cacao, and Coconuts.
- II Live Stock.
- III Vegetables, etc.
- IV Marine Products.
- V Tobacco, Cotton, and Rubber.

CLASS I.

During the years under review (1902 to 1914) the sugar industry has fallen off greatly. The cacao and coconut industries on the other hand have made remarkable progress.

The exports of cacao and coconuts have each more than quadrupled in value. The value of the cacao exported now amounts to one-half of the total exports, and coconuts to one-sixth.

CLASS II.

The exports of live stock are approximately equal in value to the exports of coconuts but there has been no appreciable expansion in this Class. In 1902-3 the exports were valued at £11,386, they have not quite reached that figure since. They fell to their lowest value (£6,204) in 1909-10 and have since steadily increased. The average annual value for the last three years exceeds £9,500.

Hopes were at one time entertained of a considerable development in the Live Stock industry of Tobago, but statistics show no increases in the export of cattle, pigs, donkeys, goats or poultry, and gradual but small increases in sheep, horses, mules, and eggs.

The Government Farm at Tobago was started in 1901 and from that date to the end of March, 1914 the total numbers of stud services are:—

Stallions	...	...	...	241
Stallion (donkey)	...	...	...	270
Bulls	...	...	...	288
Boars	...	...	...	280
Rams	...	...	...	86

CLASS III.

The exports of vegetables have not increased in value. Peas have increased considerably in the last two years, but the increase shown during 1911 to 1913 in Fruit has not been maintained in 1914.

CLASS IV.

The marine products are still worthy of attention.

CLASS V.

These may be regarded as experimental industries. Tobacco has increased largely and should receive further attention; cotton and rubber have fallen off in 1914.

EXPORTS OF SUGAR, CACAO, AND COCONUTS—1902 TO 1914.

Values in £ sterling.

Year.	Rum	Molasses	Sugar	Cacao	Coconuts.			
					Nuts	Oil	Copra	
1902	...	187	...	2,141	7,078	106	2,165	208
1903	...	350	242	2,247	5,799	369	1,709	354
1904	...	200	58	3,243	8,984	301	2,143	409
1905	621	2,987	9,457	248	1,588	807
1906	162	1,580	10,457	280	1,611	482
1907	102	1,989	22,808	143	1,801	1,798
1908	368	2,744	16,455	357	1,904	1,988
1909	54	764	16,150	912	1,874	1,680
1910	101	1,956	23,276	2,713	1,755	1,747
1911	97	1,941	26,688	7,912	982	1,299
1912	27	711	20,252	6,833	932	2,682
1913	70	32,295	6,988	255	1,593
1914	1	643	30,844	4,182	120	6,357

EXPORTS OF LIVE STOCK 1902 TO 1914.

VALUES IN £ STERLING.

Year (ending March 31.)	Cattle.	Sheep.	Pigs.	Horses.	Mules.	Donkeys.	Goats.	Poultry.	Eggs.	
1903	...	6,516	181	1,652	737	36	33	546	1,522	163
1904	...	2,604	78	1,363	350	...	3	392	1,397	252
1905	...	2,820	92	1,488	637	...	18	364	1,463	168
1906	...	3,726	102	1,359	1,000	63	24	472	1,645	260
1907	...	3,600	97	1,326	1,337	20	26	260	1,285	201
1908	...	3,166	95	1,555	1,362	120	17	219	1,069	116
1909	...	2,868	152	1,636	1,475	100	20	382	1,362	178
1910	...	2,226	181	1,263	1,000	20	28	282	1,125	79
1911	...	2,586	295	1,380	1,575	180	40	331	1,297	197
1912	...	3,138	306	1,392	1,212	240	28	368	1,376	321
1913	...	3,682	415	1,399	1,025	680	56	362	1,584	533
1914	...	3,812	538	1,348	1,912	480	24	451	1,915	538
1915	...	2,700	608	1,415	2,160	200	32	413	1,442	298
Average values in recent years	£6	16/-	15/-	{ £12 10 to £15 }	£20	£4	4/-	{ 15/- (dozen)	1/1 (dozen)	

LIVE STOCK.

NUMBERS EXPORTED.

Year (ending March 31).	Cattle.	Sheep.	Pigs.	Horses.	Mules.	Donkeys.	Goats.	Poultry.	Eggs.
								(dozen).	(dozen).
1903	1,086	231	2,203	59	3	11	1,823	2,030	3,859
1904	434	98	1,789	28	...	1	1,509	1,863	5,048
1905	470	115	1,985	51	...	7	1,214	1,951	3,367
1906	621	128	1,813	80	3	8	1,575	2,194	5,218
1907	600	122	1,769	107	1	7	1,086	1,713	4,035
1908	528	119	2,074	109	6	5	1,051	1,426	2,332
1909	478	191	2,182	118	5	5	1,912	1,817	3,577
1910	371	226	1,684	80	1	7	1,410	1,501	1,593
1911	431	369	1,840	126	9	10	1,655	1,729	3,958
1912	528	383	1,857	97	12	7	1,841	1,835	6,435
1913	614	519	1,867	82	34	14	1,810	2,112	11,679
1914	552	673	1,798	153	24	6	2,256	2,554	10,770
1915	450	761	1,887	144	10	8	2,066	1,923	5,976

EXPORTS OF VEGETABLES, AND MARINE PRODUCTS-
1902 TO 1914.

Values in £ Sterling.

Year.	Vegetables	Fruit	Peas	Fish	Turtle	Turtle Shell
1902	4,725	...	258	80	309	291
1903	3,477	183	70	26	182	576
1904	5,381	125	59	54	183	473
1905	3,241	128	133	72	365	380
1906	3,135	94	227	62	191	100
1907	3,339	219	519	124	382	442
1908	2,798	12	469	200	389	580
1909	3,440	137	172	10	302	512
1910	4,082	298	293	42	315	479
1911	3,265	519	248	5	460	374
1912	2,504	590	124	14	274	470
1913	3,254	552	908	31	102	621
1914	3,271	211	1,028	31	63	725

EXPORTS OF TOBACCO, COTTON, AND RUBBER—1902 TO 1914.

Values in £ Sterling.

Year.			Tobacco Leaf.	Cotton		Rubber	Annual Total values of Exports.
				Lint	Seed		
1902	...	...	839	...	...	...	29,918
1903	...	...	153	38	...	...	22,682
1904	...	...	84	73	18	13	24,359
1905	...	...	408	324	52	72	29,997
1906	...	...	153	278	2	283	28,687
1907	...	...	193	265	...	327	43,225
1908	...	...	325	681	53	197	38,439
1909	...	...	157	648	56	396	33,294
1910	...	...	677	449	59	1,521	46,315
1911	...	...	219	282	29	1,547	55,012
1912	...	...	123	672	61	1,869	48,232
1913	...	...	946	523	42	474	60,269
1914	...	...	8,010	145	18	18	60,482

FODDER PLANTS.

CORN GRASS.

IDENTIFICATION.

WITHIN recent date enquiries have reached the Herbarium of the Department, as to the identity of a grass known locally as corn grass and described as a useful fodder plant.

Investigation proves it to be *Manisurus exaltata*, L., or as determined at Kew (Herbarium sheet No. 3221) in the year 1889, from specimens gathered in 1886, *Rottbællia exaltata*, L., fil.

Another specimen (4133) found at Mount Pleasant, Claxton Bay, was received from Sir G. Townsend Fenwick during October, 1889, and on the sheet is the following note by the late Mr. J. H. Hart, "overruns cane pieces. A bad weed."

Coming to more recent times specimens received on November 2, 1911, bear this note by the Assistant Director (Mr. W. G. Freeman) "Grass sent herewith. . . . received from Tacarigua where it is said to be wild under the name corn grass."

This grass was undoubtedly introduced into Trinidad (it has so far not been found in Tobago) as it does not appear to be a native. It has spread to Icacos where it was collected during the past few months by the writer. At Claxton Bay, and for many miles round about that part of the island the corn grass grows in great quantities and along the railway line shortly after leaving Port-of-Spain it has become established and is spreading.

When young, animals eat it; at this stage of growth it resembles maize or corn in appearance, hence the local name of corn grass. When fully developed it is a tall branching grass, more or less clothed with sharp, piercing hairs upon the leaf sheaths. The seed-parts readily become detached from the parent plant, drop to the ground and grow freely. One singular feature noticed last year was that the older plants died down in the midst of the rainy season, but whether this is an annual occurrence, or not, is not at present known.

W. E. BROADWAY.

The following notes, contributed by Mr. H. S. Shrewsbury, Principal Assistant Analyst, indicate the value as fodder of this corn grass.—(ED.)

COMPOSITION AND FOOD VALUE.

The following analyses of three samples of the grass *Rottbællia exaltata* were made and published in the *Annual Report* of the Laboratory for 1905-06.

		AS RECEIVED.		
		No. 291.	No. 461.	No. 992.
Water	...	14.60	22.25	29.80
Ash	...	14.86	11.20	11.53
Organic Matter *	...	70.54	66.55	58.67
		100.00	100.00	100.00

* Containing

Total Nitrogen	...	2.08	1.26	0.85
Amide Nitrogen	...	0.83	0.56	0.29

DRY BASIS.

(Grass dried at 100° C.

Soluble proteins	...	2.65	0.42	1.15
Insoluble proteins	...	4.92	5.20	8.88
Digestible fibre	...	38.56	85.28	89.68
Woody fibre	...	26.25	82.54	24.15
Soluble ash	...	9.45	9.09	7.79
Insoluble ash	...	5.41	5.80	8.74
Chlorophyll, amides, &c.	...	17.76	12.17	19.71
		100.00	100.00	100.00

The report states that "it is known locally as a weed sometimes troublesome to cane growers, but in the early stages of growth when young and tender it should be a useful fodder."

The values as fodder of the local *Rottbællia exaltata* and *Euchlæna luxurians* with those of other grass fodders are compared in the following table. The figures express the percentages of digestible matter in the fodders dried at 100 deg. C.

The fodders have been arranged in order of their economic significance No. 1 being the most valuable, and No. 15 the least.

The Trinidad grasses occupy the ninth, tenth, thirteenth and fifteenth places and are accordingly to be classed among the less valuable grass fodders.

1. Corn fodder, flint	...	...	...	78
2. Corn fodder, sweet	...	...	...	77
3. Hungarian hay...	...	...	...	74
4. Corn fodder, dent	...	...	...	73
5. Timothy, in bloom or before	...	...	...	70
6. Red top hay	...	...	...	69
7. Corn stover	...	...	...	65
8. Orchard grass hay	...	...	...	65
9. <i>Rottbællia exaltata</i> , Trinidad, B.W.I. No. 992 of 1905	...	...	...	64
10. <i>Euchlæna luxurians</i> , in fruiting stage, Trinidad, B.W.I. No. 807 of 1911	...	...	...	63
11. Timothy, all	...	...	...	61
12. Timothy, after bloom	...	...	...	61
13. <i>Rottbællia exaltata</i> , Trinidad, B.W.I. No. 291 of 1905	...	...	...	59
14. Oat straw	...	...	...	57
15. <i>Rottbællia exaltata</i> , Trinidad, B.W.I. No. 461 of 1905	...	...	...	58

The poorest local *Rottbællia exaltata* has approximately seven-tenths the food value of corn fodder, flint.

FORESTRY.

TESTS ON THE DURABILITY OF GREENHEART.

THE results of experiments in the resistance of greenheart to wood-destroying fungi carried out during the years 1913-1914 by C. J. Humphrey of the U.S. Department of Agriculture, have just been published.⁽¹⁾

Greenheart is a tropical timber-tree which has world-wide reputation for extreme durability; being resistant not only to wood-destroying fungi, but to termites and marine borers as well.

Humphrey states that the proportion of sapwood in a log is usually high, three to four inches in thickness in trunks eighteen to twenty-four inches in diameter, while trees under twelve inches usually consist largely of sapwood. The tests were carried out to determine whether or not the sapwood is inferior to the heartwood in its resistant qualities.

The experiment was carried out with blocks of greenheart $\frac{3}{4}$ in. by $\frac{3}{4}$ in. by 2 inches long, cut respectively from the centre and the outside of a log from *Deacarya*. Each block was tested singly in a large test tube, the resistance of heartwood and sapwood to the same organisms being compared.

Twenty-three species of wood-destroying fungi were used. The blocks were dried in an oven at 100 deg. to 105 deg. C. for twenty hours and weighed. They were then put in tap water and boiled.

"The tube cultures were prepared by placing a layer of wet sterilized sphagnum moss in the bottom, followed by a layer of moist sterile sand, up to about two-fifths the length of the tube. The test block was embedded in this sand for about one-half its length and surrounded by culture blocks of spruce or beech, the former being used in the case of fungi known to inhabit coniferous timber and the latter in the case of hardwood fungi. Over the whole was packed a layer of wet sphagnum. Tap water was then added to saturate the sphagnum and sand in the bottom and the tubes were then tightly plugged with absorbent cotton.

After sterilization of about one hour at twelve pounds steam pressure, the tubes were allowed to cool and were inoculated on August 28 and 29 with various wood-destroying fungi, among which are included many of the most active ones prevalent in the United States."

After a year the tubes were opened. The blocks were examined for rot, dried out again in the oven and re-weighed, and the essential data and results presented in tabular form.

(1) "Tests on the Durability of Greenheart (*Nectandra rodiaei* Schomb.)" by C. J. Humphrey. *Mycologia*, Vol. VII, No. 4 pp. 204-209. 1 Plate, July 1915.

An examination of the tables shows that the heartwood of greenheart is highly resistant, in fact, practically immune to all the fungi used; though the optimum conditions for their development were present for a year's time. The blocks of other woods in the tubes were thoroughly rotted in almost every case.

The sapwood blocks however, proved far less resistant to the fungi. The wood remained immune to only three of the twenty-three fungi tested, ranging in the other cases from slightly affected to considerably rotted and losing from ten per cent. to thirty-seven per cent. in weight.

Though some dealers do not regard the sapwood of greenheart as inferior to heartwood, these tests of Humphrey show that there is a marked difference; and this point should be borne in mind in timber specifications which call for the best quality of durable material.

J.B.R.

MEDICINAL PLANTS.

PURGATIVE PROPERTIES OF *GARCIA NUTANS*.

By A. E. COLLENS, F.C.S.,

Officer in charge of Special Investigations.

A SHORT time ago a few seeds were received from the Superintendent of Prisons for identification and for any information as to their physiological action as some had been eaten with unpleasant and painful results, by men whilst at work in the vicinity of Government House. The seeds measured 15 m.m. long by 13 x 12 m.m., were of a rusty brown colour, mottled with grey and had a raised edge and characteristic hilum: they were contained in a three-lobed capsule which had burst. A single seed weighed .943 grammes (14 grains) and the entire kernel .69 grammes (or 10.64 grains).

The seeds were identified as being those of *Garcia nutans*, a euphorbiaceous tree. They are known to have properties similar to castor oil seeds and to contain a tox-albumose similar to ricin. The physiological action of these seeds was investigated and reported upon in 1908 by Professor Theodore Cash, M.D., of Aberdeen, who states:—

“A sensation indicating oil is produced on chewing the seeds which develops into an unpleasant and somewhat persistent tickling or scratching sensation in the region of the soft palate and fauces.”

“The seed when swallowed in a dose of 0.6 gram (9 grains) in addition to the faucial sensation produce later gastric discomfort, shifting abdominal uneasiness and active purgation. From a dose of 0.4 gram (6.17 grains) a single purgation may be anticipated in a few hours and 0.2 gram (3 grains) acts as a laxative the following morning. The full dose of the seed of *Garcia nutans* is therefore a drastic hydragogue cathartic and should be used with caution.”

As the dose (0.6 gramme) mentioned by Professor Cash as causing active purgation and gastric discomfort is approximately the weight of an entire kernel, further particulars were requested from the Superintendent of Prisons with reference to the symptoms displayed and remedial measures adopted; the following history of the case was obtained:

“Eight men were brought from Government House grounds with a history of having eaten of the kernel of some nut growing there. They all suffered from severe vomiting, purging gripes, inability to hold up and of severe burning sensation in the stomach. They were subnormal and had cold and clammy perspiration and all complained of feeling very faint. For treatment the stomach was emptied and diffusible stimulants given. Six were quite all right the day after and the other two felt a bit uncomfortable about the bowels for two or three days after. No after effects were observable.”

Many of the seeds of plants of the natural order *Euphorbiaceae* possess a bland pleasant taste such as *Aleurites* sp. (Candle nut). *Omphalea triandra* (Jamaica cob nut) *Omphalea megacarpa* (hunterman's nut) coupled with mild purgative properties. These can be safely eaten and in fact form a pleasant way of taking a natural purgative, while others such as *Jatropha curcas* L. (Physic nut), *J. gossypifolia* L. (Bastard French physic nut or belly-ache bush) and *J. multifida* L. (coral flower or French physic nut) while possessing similar purgative qualities can only be utilised with caution and have often produced grave results through lack of sufficient knowledge of their properties. *Jatropha* oil is very similar to croton oil both physiologically and chemically. According to Grosourdy the eating of four seeds of *Jatropha curcas* was accompanied by a disagreeable sensation both in the stomach and in the intestines together with nausea which later on terminated in vomiting, the purging effect became manifested later and was of a gentle character; the sensation of uneasiness disappeared later but the intestinal heat continued for some time. The eating of five seeds by a labourer caused vomiting, sweats, debility, vertigo and even delirium, 4 hours after when received at the London Hospital the pupils of the eyes were natural, skin pale, hands cold and pulse frequent at 140 beats to the minute. An opiate and a cordial were administered and he shortly recovered. The seeds of *J. gossypifolia* possess similar properties while those of the *J. multifida* are even more violent. It is stated that the active principle is contained in the embryo of the seeds and that if it be removed much of the toxic action is eliminated.

BOTANICAL. NURSERY WORK.

St. Clair Nurseries July to September, 1915.

Plants.

	Sold.	Distributed in exchange or gratis.
Cacao		
Budded	160	1
Grafted	16	—
Selected seedlings	8,730	6
Coffee		
Robusta	1,126	—
Other varieties	2,513*	3
Limes		
Budded	130	—
Seedlings	4,851	—
Fruits		
Mangos (grafted)	38	1
Citrus (budded)	133	—
" " Grape fruit	255	—
" (seedlings)	26	6
Miscellaneous	197	14
Spices... ..	60	8
Shade	56	24
Rubber	12†	—
Timber	516	6
Palms	279	18
Ferns	11	6
Flowering Plants (decorative)	808‡	132
Foliage " "	121	—
Totals	19,978	225

* 2,400 from under trees. † Stumps. ‡ 606 cuttings.

Seeds.

	Sold.	Distributed in exchange.
Nutmeg	35 lbs.	—
Countable seeds	50	350
Packets "	4	8

The receipts for the same period amounted to £218 1 3.

METEOROLOGY.

RAINFALL RETURN FOR AUGUST, SEPTEMBER AND OCTOBER, 1915.

STATIONS.	August, 1915.		August, 1914.		Jan. to Aug., 1915.		Jan. to Aug., 1914.		Sep., 1915.		Sep., 1914.		Jan. to Sep., 1915.		Jan. to Sep., 1914.		Oct., 1915.		Oct., 1914.		Jan. to Oct., 1915.		Jan. to Oct., 1914.	
	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	
<i>North West District.</i>																								
St. Clair—Royal Botanic Gardens	5.27	9.15	33.23	26.99	4.21	7.80	37.44	34.79	9.28	6.14	46.72	40.93	46.72	40.93	9.28	6.14	46.72	40.93	46.72	40.93	46.72	40.93	46.72	40.93
Port of Spain—Colonial Hospital	3.85	4.19	24.37	19.71	4.54	7.60	28.91	27.31	6.69	4.69	32.90	32.90	32.90	32.90	6.69	4.69	32.90	32.90	32.90	32.90	32.90	32.90	32.90	32.90
" " Royal Gaol	5.04	5.10	29.75	21.32	5.10	8.71	34.85	30.03	7.19	5.32	42.04	35.35	42.04	35.35	7.19	5.32	42.04	35.35	42.04	35.35	42.04	35.35	42.04	35.35
" " Constabulary Head-quarters	2.61	5.71	22.60	22.77	2.05	5.14	24.65	27.91	3.49	4.37	28.14	32.48	28.14	32.48	3.49	4.37	28.14	32.48	28.14	32.48	28.14	32.48	28.14	32.48
St. Ann's—Reservoir	4.99	10.04	37.48	29.63	5.56	6.40	43.04	36.03	10.78	5.37	53.82	41.40	53.82	41.40	10.78	5.37	53.82	41.40	53.82	41.40	53.82	41.40	53.82	41.40
Maraval—Reservoir	7.18	7.57	39.54	27.83	6.39	7.07	45.93	34.90	8.43	6.84	54.36	41.74	54.36	41.74	8.43	6.84	54.36	41.74	54.36	41.74	54.36	41.74	54.36	41.74
" " Constabulary Station	9.99	6.02	48.48	29.02	7.85	9.30	56.33	38.32	10.81	11.63	67.14	49.95	67.14	49.95	10.81	11.63	67.14	49.95	67.14	49.95	67.14	49.95	67.14	49.95
Diego Martin	5.73	4.10	42.79	25.68	6.92	10.34	49.71	36.02	8.01	10.05	57.72	46.67	57.72	46.67	8.01	10.05	57.72	46.67	57.72	46.67	57.72	46.67	57.72	46.67
" " Waterworks	6.79	4.65	39.09	26.88	6.06	9.58	45.15	36.46	8.85	10.81	54.00	47.27	54.00	47.27	8.85	10.81	54.00	47.27	54.00	47.27	54.00	47.27	54.00	47.27
" " River Estate	7.05	4.74	40.38	27.69	6.06	9.21	48.44	36.90	8.45	9.83	54.89	46.73	54.89	46.73	8.45	9.83	54.89	46.73	54.89	46.73	54.89	46.73	54.89	46.73
Fort George Signal Station	10.26	11.89	38.73	32.32	3.70	5.32	42.43	37.04	9.66	9.43	51.99	47.07	51.99	47.07	9.66	9.43	51.99	47.07	51.99	47.07	51.99	47.07	51.99	47.07
North Post	5.35	4.86	32.19	25.29	7.53	7.42	39.72	32.71	6.19	9.76	45.91	39.34	45.91	39.34	6.19	9.76	45.91	39.34	45.91	39.34	45.91	39.34	45.91	39.34
Carenage Constabulary Station	8.14	13.53	45.33	41.19	4.49	5.85	49.82	47.04	5.31	12.30	55.13	59.34	55.13	59.34	5.31	12.30	55.13	59.34	55.13	59.34	55.13	59.34	55.13	59.34
Carriacou Island Convict Depot	6.40	10.31	27.32	27.34	3.91	6.45	31.23	33.79	3.82	7.70	35.05	41.49	35.05	41.49	3.82	7.70	35.05	41.49	35.05	41.49	35.05	41.49	35.05	41.49
Chacocharo Light House	63.7	4.91	29.25	23.32	3.76	5.81	33.01	29.13	4.51	5.44	37.52	34.57	37.52	34.57	4.51	5.44	37.52	34.57	37.52	34.57	37.52	34.57	37.52	34.57
<i>Santa Cruz—Maracas District.</i>																								
Santa Cruz Constabulary Station	7.06	5.09	40.82	30.31	3.56	7.71	44.38	38.02	8.76	10.94	53.14	48.96	53.14	48.96	8.76	10.94	53.14	48.96	53.14	48.96	53.14	48.96	53.14	48.96
St. Joseph, Government Farm	4.42	5.16	35.86	24.01	5.59	5.03	41.45	30.86	7.87	7.27	50.79	38.13	50.79	38.13	7.87	7.27	50.79	38.13	50.79	38.13	50.79	38.13	50.79	38.13
St. Joseph, Constabulary Station	1.91	4.55	23.12	21.51	3.80	5.03	26.92	20.54	7.61	7.07	34.53	33.59	34.53	33.59	7.61	7.07	34.53	33.59	34.53	33.59	34.53	33.59	34.53	33.59
Tunapuna, St. Augustine Estate	3.67	4.28	32.97	22.08	5.03	6.73	38.00	28.81	8.42	5.93	46.42	34.74	46.42	34.74	8.42	5.93	46.42	34.74	46.42	34.74	46.42	34.74	46.42	34.74
Maracas—Government School	7.14	5.36	35.76	25.55	4.88	9.37	40.64	34.92	10.10	13.08	50.74	48.00	50.74	48.00	10.10	13.08	50.74	48.00	50.74	48.00	50.74	48.00	50.74	48.00
" " Orinola Estate	7.49	4.15	38.47	24.90	4.85	7.84	43.32	32.74	10.10	7.98	53.42	40.72	53.42	40.72	10.10	7.98	53.42	40.72	53.42	40.72	53.42	40.72	53.42	40.72
Caura, Wardour Estate	6.77	4.75	32.10	23.74	7.38	6.32	39.48	30.06	6.41	6.92	45.89	36.98	45.89	36.98	6.41	6.92	45.89	36.98	45.89	36.98	45.89	36.98	45.89	36.98
<i>West Central District.</i>																								
Caroni, Frederick Estate	5.46	13.80	43.01	63.92	5.44	12.33	48.45	76.25	8.77	7.06	57.22	83.31	57.22	83.31	8.77	7.06	57.22	83.31	57.22	83.31	57.22	83.31	57.22	83.31
Chaguanae, Constabulary Station	8.59	5.92	41.04	24.27	5.40	9.64	46.44	33.91	9.70	5.33	56.14	39.24	56.14	39.24	9.70	5.33	56.14	39.24	56.14	39.24	56.14	39.24	56.14	39.24
Chaguanae, Woodford Lodge Estate	7.18	5.98	40.02	26.47	5.56	9.62	45.58	36.09	9.46	4.79	55.04	40.98	55.04	40.98	9.46	4.79	55.04	40.98	55.04	40.98	55.04	40.98	55.04	40.98
" " Carapichaima, Waterloo Estate	4.47	5.41	53.48	23.42	5.68	7.06	39.16	30.47	11.70	3.80	50.86	34.27	50.86	34.27	11.70	3.80	50.86	34.27	50.86	34.27	50.86	34.27	50.86	34.27
" " Friendship Hall Estate	11.55	3.65	45.32	25.22	5.12	7.89	50.44	33.11	9.12	4.40	59.56	37.51	59.56	37.51	9.12	4.40	59.56	37.51	59.56	37.51	59.56	37.51	59.56	37.51

RAINFALL RETURN FOR AUGUST, SEPTEMBER AND OCTOBER, 1915.—CONTINUED.

STATIONS.	August, 1916.		August, 1914.		Jan. to Aug. 1915		Jan. to Aug. 1914.		Sept., 1915.		Sept., 1914.		Jan. to Sep. 1915.		Jan. to Sep. 1914.		Oct., 1915.		Oct., 1914.		Jan. to Oct. 1915.		Jan. to Oct. 1914.	
	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	
<i>West Central District.—Contd.</i>																								
Couva, Exchange Estate	7-22	3-12	37-27	20-33	5-02	7-38	42-29	27-71	9-84	5-63	52-13	33-34	42-29	27-71	9-84	5-63	52-13	33-34	5-63	52-13	33-34	52-13	33-34	52-13
" Brechin Castle	7-11	3-45	38-04	23-46	4-83	9-15	42-87	32-61	8-73	5-75	51-60	41-72	42-87	32-61	8-73	5-75	51-60	41-72	5-75	51-60	41-72	51-60	41-72	51-60
" Perseverance	4-99	3-87	31-67	26-90	...	9-43	42-87	36-33	11-69	5-39	42-87	36-33	11-69	5-39	5-39
" Camden	8-21	3-43	26-58	19-41	4-27	6-41	30-85	25-82	8-10	6-52	38-95	32-34	30-85	25-82	8-10	6-52	38-95	32-34	8-10	6-52	38-95	32-34	38-95	
" Milton	9-62	3-04	44-39	21-21	7-22	8-96	50-61	30-17	7-04	9-41	58-65	39-58	50-61	30-17	7-04	9-41	58-65	39-58	9-41	58-65	39-58	61-39	36-33	
" Spring	13-26	3-96	47-62	23-42	6-21	6-74	53-83	39-16	7-56	6-17	61-39	36-33	53-83	39-16	7-56	6-17	61-39	36-33	6-17	61-39	36-33	61-39	36-33	
" Constabulary Station	5-86	3-22	35-24	22-80	7-35	8-94	42-53	31-74	8-94	6-82	51-53	38-56	42-53	31-74	8-94	6-82	51-53	38-56	8-94	6-82	51-53	38-56	51-53	
" Esperanza Estate, Savonetta	8-48	2-98	39-18	20-57	5-32	9-14	44-50	29-71	7-16	6-15	51-46	35-86	44-50	29-71	7-16	6-15	51-46	35-86	7-16	6-15	51-46	35-86	51-46	
<i>Montserrat District.</i>																								
Montserrat, Constabulary Station	11-41	3-52	45-26	24-02	5-15	7-65	50-41	31-97	8-36	6-81	38-77	38-48	50-41	31-97	8-36	6-81	38-77	38-48	8-36	6-81	38-77	38-48	38-77	
Brasso, La Vega Estate	11-21	4-06	56-12	30-09	5-38	8-43	61-50	38-52	16-70	10-14	78-50	48-66	61-50	38-52	16-70	10-14	78-50	48-66	16-70	10-14	78-50	48-66	78-50	
<i>Arima District.</i>																								
Arima, Warden's Office	7-94	5-64	35-33	25-20	4-90	7-54	40-23	32-74	6-55	5-38	46-78	38-12	40-23	32-74	6-55	5-38	46-78	38-12	6-55	5-38	46-78	38-12	46-78	
Arima, Torrecilla Estate	4-95	9-48	48-53	40-98	8-35	6-15	50-88	47-03	7-06	12-13	63-94	59-16	50-88	47-03	7-06	12-13	63-94	59-16	7-06	12-13	63-94	59-16	63-94	
Arima, Verdant Vale Estate	9-08	5-93	46-31	36-16	8-09	8-20	54-40	44-36	9-33	11-76	63-73	56-12	54-40	44-36	9-33	11-76	63-73	56-12	9-33	11-76	63-73	56-12	63-73	
San Rafael, Constabulary Station	5-63	8-55	57-19	42-49	9-35	11-94	66-74	54-43	9-83	7-87	70-57	62-30	66-74	54-43	9-83	7-87	70-57	62-30	9-83	7-87	70-57	62-30	70-57	
Guanapo, Talparo Estate	7-19	9-41	57-50	37-49	9-33	7-35	66-83	44-84	8-10	5-19	74-93	50-03	66-83	44-84	8-10	5-19	74-93	50-03	8-10	5-19	74-93	50-03	74-93	
Guanapo, San José Estate	7-09	8-90	58-36	37-49	8-76	6-71	67-12	...	9-99	7-67	77-11	...	67-12	...	9-99	7-67	77-11	...	9-99	7-67	77-11	...	...
Tamana, Santa Marta Estate	10-33	9-63	61-23	46-00	10-04	6-48	71-27	52-48	9-20	8-07	80-47	61-55	71-27	52-48	9-20	8-07	80-47	61-55	9-20	8-07	80-47	61-55	...	
<i>San Fernando & Princess Town District.</i>																								
Claxton's Bay, Forbes Park Estate	7-16	2-41	36-36	16-38	8-14	7-34	44-50	23-72	5-48	4-80	49-08	28-52	44-50	23-72	5-48	4-80	49-08	28-52	5-48	4-80	49-08	28-52	49-08	
Pouente-a-Pierre, Bonne Adventure Est.	9-74	3-23	42-70	24-60	6-08	4-84	49-08	23-34	4-77	6-93	54-45	36-27	49-08	23-34	4-77	6-93	54-45	36-27	4-77	6-93	54-45	36-27	54-45	
" Concord Estate	9-63	3-24	46-90	25-20	7-01	6-65	53-91	31-85	5-29	5-49	59-20	40-29	53-91	31-85	5-29	5-49	59-20	40-29	5-29	5-49	59-20	40-29	59-20	
" Plein Palais Estate	7-90	3-11	37-20	19-42	5-65	8-96	46-25	28-38	5-85	5-97	48-70	34-35	46-25	28-38	5-85	5-97	48-70	34-35	5-85	5-97	48-70	34-35	48-70	
Naparima, Picton Estate	5-59	3-15	39-98	20-81	6-27	5-99	46-25	26-80	5-39	3-18	51-64	29-98	46-25	26-80	5-39	3-18	51-64	29-98	5-39	3-18	51-64	29-98	51-64	
" Usine Ste. Madeleine Est.	6-36	2-93	40-36	23-82	4-50	7-76	44-86	31-58	5-36	4-63	50-22	36-21	44-86	31-58	5-36	4-63	50-22	36-21	5-36	4-63	50-22	36-21	50-22	
" La Fortune Estate	6-81	3-91	35-54	21-32	4-16	5-79	39-70	27-71	6-52	6-35	46-22	34-06	39-70	27-71	6-52	6-35	46-22	34-06	6-52	6-35	46-22	34-06	46-22	
" Lewisville	9-46	4-80	46-20	27-37	5-07	7-64	51-27	36-01	7-04	6-43	58-31	41-44	51-27	36-01	7-04	6-43	58-31	41-44	7-04	6-43	58-31	41-44	58-31	

RAINFALL RETURN FOR AUGUST, SEPTEMBER AND OCTOBER, 1915.—CONTINUED.

STATIONS.	Aug., 1915.		Aug., 1914.		Jan. to Aug., 1915.		Jan. to Aug., 1914.		Sep., 1915.		Sep., 1914.		Jan. to Sep., 1915.		Jan. to Sep., 1914.		Oct., 1915.		Oct., 1914.		Jan. to Oct., 1915.		Jan. to Oct., 1914.		
	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.		
<i>San Fernando & Princes Town District.</i>																									
<i>(Contd.)</i>																									
Naparima, Tarouba Estate...	6.91	2.65	33.56	16.93	2.67	5.89	36.23	22.82	3.69	4.90	39.92	27.72	3.69	4.90	39.92	27.72	3.69	4.90	39.92	27.72	3.69	4.90	39.92	27.72	
" Union Hall Estate	4.63	2.63	31.87	22.04	3.49	6.11	35.36	29.15	5.55	5.26	40.91	33.41	5.55	5.26	40.91	33.41	5.55	5.26	40.91	33.41	5.55	5.26	40.91	33.41	
" Palmiste "	6.89	3.62	42.99	23.36	5.18	7.53	43.17	31.09	7.34	4.39	55.51	35.48	7.34	4.39	55.51	35.48	7.34	4.39	55.51	35.48	7.34	4.39	55.51	35.48	
" Hermitage "	6.90	3.52	38.05	23.08	5.06	6.44	43.11	29.52	7.84	4.80	48.45	34.32	7.84	4.80	48.45	34.32	7.84	4.80	48.45	34.32	7.84	4.80	48.45	34.32	
Princes Town Craignish Estate	7.76	4.66	43.99	31.88	4.03	5.24	48.02	37.12	7.95	4.74	56.97	41.86	7.95	4.74	56.97	41.86	7.95	4.74	56.97	41.86	7.95	4.74	56.97	41.86	
" Cedar Hill Estate	8.21	3.53	42.51	28.14	4.99	6.77	47.50	34.91	6.82	4.87	54.32	39.78	6.82	4.87	54.32	39.78	6.82	4.87	54.32	39.78	6.82	4.87	54.32	39.78	
" Williamsville Estate	14.47	4.01	50.27	29.68	7.47	8.24	57.74	35.22	7.21	6.66	64.95	41.88	7.21	6.66	64.95	41.88	7.21	6.66	64.95	41.88	7.21	6.66	64.95	41.88	
" Kemerda Estate	8.84	4.55	45.52	30.09	6.14	8.24	57.63	38.33	12.41	7.21	64.07	45.14	12.41	7.21	64.07	45.14	12.41	7.21	64.07	45.14	12.41	7.21	64.07	45.14	
" New Grant Estate	10.59	6.95	56.74	37.60	5.44	6.81	62.18	43.81	6.27	7.39	68.45	51.20	6.27	7.39	68.45	51.20	6.27	7.39	68.45	51.20	6.27	7.39	68.45	51.20	
" Constabulary Station	5.71	2.66	30.52	13.83	3.65	4.58	34.17	23.41	4.44	3.71	38.61	27.12	4.44	3.71	38.61	27.12	4.44	3.71	38.61	27.12	4.44	3.71	38.61	27.12	
" Hindustan Estate	9.00	4.99	50.16	31.78	4.40	4.81	54.56	56.59	4.06	5.93	58.62	42.52	4.06	5.93	58.62	42.52	4.06	5.93	58.62	42.52	4.06	5.93	58.62	42.52	
" La Retraite Estate	9.59	7.37	63.79	47.49	5.72	8.13	69.51	55.62	6.66	10.65	76.17	66.27	6.66	10.65	76.17	66.27	6.66	10.65	76.17	66.27	6.66	10.65	76.17	66.27	
" Malgretoute "	10.18	4.15	43.82	29.19	6.41	5.00	50.23	34.19	9.75	5.16	59.98	39.35	9.75	5.16	59.98	39.35	9.75	5.16	59.98	39.35	9.75	5.16	59.98	39.35	
Sav. Grande, Friendship & Ben Lomond Estates	11.21	4.46	44.09	25.61	5.31	8.77	49.90	34.88	4.40	6.11	54.30	40.49	4.40	6.11	54.30	40.49	4.40	6.11	54.30	40.49	4.40	6.11	54.30	40.49	
Poole, El Rosario Estate	9.56	6.44	61.78	40.46	10.12	6.69	71.90	47.15	8.35	5.91	80.25	53.06	8.35	5.91	80.25	53.06	8.35	5.91	80.25	53.06	8.35	5.91	80.25	53.06	
<i>South-West District.</i>																									
Oropuche, Constabulary Station	6.23	5.88	44.02	34.74	4.00	5.80	48.02	40.54	8.01	8.63	56.03	49.17	8.01	8.63	56.03	49.17	8.01	8.63	56.03	49.17	8.01	8.63	56.03	49.17	
" Pinck Estate	6.30	3.58	40.64	23.38	4.92	5.67	45.56	29.05	7.05	9.83	52.61	38.68	7.05	9.83	52.61	38.68	7.05	9.83	52.61	38.68	7.05	9.83	52.61	38.68	
Siparia, Constabulary Station	8.79	6.25	53.19	39.47	6.99	7.65	60.18	47.12	7.65	60.18	47.12	7.65	60.18	47.12	7.65	60.18	47.12	7.65	60.18	47.12	7.65	60.18	47.12	7.65	60.18
" Alta Gracia Estate	7.12	5.30	40.31	24.31	4.63	5.21	44.94	33.96	5.21	44.94	33.96	5.21	44.94	33.96	5.21	44.94	33.96	5.21	44.94	33.96	5.21	44.94	33.96	5.21	44.94
Guspo, Adventure Estate	3.47	5.41	36.81	28.86	5.24	8.08	42.05	36.96	5.46	7.26	47.51	44.22	5.46	7.26	47.51	44.22	5.46	7.26	47.51	44.22	5.46	7.26	47.51	44.22	
Cap-de-Ville—Constabulary Station	6.13	7.38	45.73	43.14	5.49	9.81	51.22	54.95	5.84	9.14	57.16	64.09	5.84	9.14	57.16	64.09	5.84	9.14	57.16	64.09	5.84	9.14	57.16	64.09	
Erin, La Ressource Estate	5.26	4.97	34.67	32.25	2.72	5.19	37.39	37.44	7.41	7.70	44.80	45.14	7.41	7.70	44.80	45.14	7.41	7.70	44.80	45.14	7.41	7.70	44.80	45.14	
" Industry Estate	4.45	6.73	33.80	37.51	6.03	5.36	30.83	42.87	9.19	4.47	49.02	47.34	9.19	4.47	49.02	47.34	9.19	4.47	49.02	47.34	9.19	4.47	49.02	47.34	
Océros, La Retraite Estate	6.65	6.42	36.79	31.94	3.73	5.73	40.32	37.67	6.11	5.36	38.52	43.06	6.11	5.36	38.52	43.06	6.11	5.36	38.52	43.06	6.11	5.36	38.52	43.06	
" Constabulary Station	5.17	5.17	31.68	31.94	0.73	7.62	32.41	37.67	6.11	4.57	49.88	43.06	6.11	4.57	49.88	43.06	6.11	4.57	49.88	43.06	6.11	4.57	49.88	43.06	
" Beaulieu Estate	5.07	5.20	31.60	28.36	1.37	7.62	32.32	35.98	4.57	4.97	38.87	40.95	4.57	4.97	38.87	40.95	4.57	4.97	38.87	40.95	4.57	4.97	38.87	40.95	
" Perseverance Estate	4.53	5.20	31.60	28.36	0.72	7.62	30.52	35.98	6.55	4.97	38.87	40.95	6.55	4.97	38.87	40.95	6.55	4.97	38.87	40.95	6.55	4.97	38.87	40.95	
" Ste. Marie Estate	5.18	5.18	29.37	29.37	1.15	7.62	30.52	35.98	5.15	5.15	36.67	40.95	5.15	5.15	36.67	40.95	5.15	5.15	36.67	40.95	5.15	5.15	36.67	40.95	

RAINFALL RETURN FOR AUGUST, SEPTEMBER AND OCTOBER, 1915. --CONTINUED.

STATIONS.		August, 1915.		August, 1914.		Jan. to Aug., 1915.		Jan. to Aug., 1914.		Sept., 1915.		Sept., 1914.		Jan. to Sep., 1915.		Jan. to Sep., 1914.		Oct., 1915.		Oct., 1914.		Jan. to Oct., 1915.		Jan. to Oct., 1914.	
		Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
<i>South-West District. — (Contd.)</i>																									
Icacos, Constance Estate		4-88	6-35	29-45	23-50	2-25	8-60	31-70	32-10	2-45	4-75	34-05	36-85	34-05	36-85	34-05	36-85	34-05	36-85	34-05	36-85	34-05	36-85	34-05	36-85
Irois, Government School ...		5-61	14-27	36-85	47-19	2-05	7-49	38-90	54-08	9-07	...	47-97	...	47-97	...	47-97	...	47-97	...	47-97	...	47-97	...	47-97	...
<i>South Coast.</i>																									
Moruga, Constabulary Station		4-08	4-44	42-97	26-82	2-69	3-58	45-66	30-40	4-32	4-69	49-98	35-09	4-69	49-98	4-69	49-98	4-69	49-98	4-69	49-98	4-69	49-98	4-69	49-98
<i>East Coast.</i>																									
Matura, La Juanita Estate...		7-25	11-96	55-83	44-21	14-42	4-59	70-25	48-80	11-01	11-04	81-26	50-84	11-01	81-26	11-01	81-26	11-01	81-26	11-01	81-26	11-01	81-26	11-01	81-26
Manzanilla, Constabulary Station		7-64	9-80	56-06	40-87	7-56	7-51	63-02	48-38	16-82	7-75	80-44	56-13	16-82	7-75	80-44	7-75	80-44	7-75	80-44	7-75	80-44	7-75	80-44	7-75
Sangre Grande, New Lands Estate		7-97	8-20	56-63	40-62	6-56	7-06	66-19	47-08	13-53	9-83	79-72	57-51	13-53	9-83	79-72	9-83	79-72	9-83	79-72	9-83	79-72	9-83	79-72	9-83
Evasdale Estate		10-13	11-13	62-35	47-98	6-77	7-41	69-39	53-39	11-31	8-49	80-45	64-98	11-31	8-49	80-45	8-49	80-45	8-49	80-45	8-49	80-45	8-49	80-45	8-49
Grosvenor Estate		9-58	10-08	66-67	43-11	7-21	6-76	73-88	49-87	15-43	10-36	89-31	60-23	15-43	10-36	89-31	10-36	89-31	10-36	89-31	10-36	89-31	10-36	89-31	10-36
San Hilario Estate		5-16	5-42	46-48	27-65	8-83	3-74	50-95	31-39	6-12	4-74	57-07	36-13	6-12	4-74	57-07	4-74	57-07	4-74	57-07	4-74	57-07	4-74	57-07	4-74
Mayaro, Constabulary Station		8-02	4-46	41-91	34-47	5-81	6-80	46-82	41-27	5-05	7-33	51-87	48-60	5-05	7-33	51-87	7-33	51-87	7-33	51-87	7-33	51-87	7-33	51-87	7-33
<i>North Coast.</i>																									
Blanchisseuse, Constabulary Station		7-08	8-25	53-75	45-40	7-62	7-10	61-37	52-50	11-61	7-85	72-98	60-35	11-61	7-85	72-98	7-85	72-98	7-85	72-98	7-85	72-98	7-85	72-98	7-85
Grande Riviere, Mon Plaisir Estate		5-05	6-25	47-11	33-23	6-07	3-93	53-18	37-16	10-09	11-43	63-27	48-39	10-09	11-43	63-27	11-43	63-27	11-43	63-27	11-43	63-27	11-43	63-27	11-43
Toco, Aragua House		5-40	5-20	42-44	30-68	7-12	3-45	57-06	34-13	6-37	9-14	56-43	45-21	6-37	9-14	56-43	9-14	56-43	9-14	56-43	9-14	56-43	9-14	56-43	9-14
Constabulary Station		4-23	2-76	32-50	17-52	7-12	1-75	57-06	19-27	6-56	9-14	43-59	28-41	6-56	9-14	43-59	9-14	43-59	9-14	43-59	9-14	43-59	9-14	43-59	9-14
Point Galera, Light House																									
<i>Tobago.</i>																									
Tobago, Hermitage Estate		11-33	4-41	51-12	32-43	9-37	7-85	60-49	40-38	13-00	11-06	73-49	51-94	13-00	11-06	73-49	11-06	73-49	11-06	73-49	11-06	73-49	11-06	73-49	11-06
" " Riversdale		7-22	5-09	37-12	21-04	7-30	4-88	45-02	23-92	5-60	6-23	50-62	32-15	5-60	6-23	50-62	6-23	50-62	6-23	50-62	6-23	50-62	6-23	50-62	6-23
" " King's Bay		7-84	4-67	46-64	29-95	10-03	6-96	56-07	36-91	12-38	6-14	69-05	43-05	12-38	6-14	69-05	6-14	69-05	6-14	69-05	6-14	69-05	6-14	69-05	6-14
" " Roxburgh		10-90	4-62	57-56	35-44	12-21	7-93	69-77	43-37	15-81	9-24	85-58	52-61	15-81	9-24	85-58	9-24	85-58	9-24	85-58	9-24	85-58	9-24	85-58	9-24
" " Lure		12-59	5-02	56-06	30-08	11-75	6-68	67-81	45-74	13-71	8-12	81-36	53-86	13-71	8-12	81-36	8-12	81-36	8-12	81-36	8-12	81-36	8-12	81-36	8-12
" " Botanic Station		7-22	4-48	41-33	25-42	7-87	5-30	49-20	30-72	10-41	6-01	59-31	36-73	10-41	6-01	59-31	6-01	59-31	6-01	59-31	6-01	59-31	6-01	59-31	6-01
" " Government Farm		6-44	2-73	28-37	13-37	6-44	3-93	34-81	17-30	10-17	3-01	44-98	20-31	10-17	3-01	44-98	3-01	44-98	3-01	44-98	3-01	44-98	3-01	44-98	3-01
" " Lowlands Estate		7-98	4-25	37-72	19-67	5-94	4-48	43-66	24-15	12-56	4-27	36-29	28-42	12-56	4-27	36-29	4-27	36-29	4-27	36-29	4-27	36-29	4-27	36-29	4-27
" " Friendship		11-29	4-77	43-57	23-29	8-24	4-01	51-81	27-39	13-04	3-32	64-85	30-62	13-04	3-32	64-85	3-32	64-85	3-32	64-85	3-32	64-85	3-32	64-85	3-32
" " Bon Accord						6-00	...	43-94		12-76		56-70		12-76		56-70		56-70		56-70		56-70		56-70	

NOTES.

THE Director of Agriculture and the Manager, Government Farm, recently visited Tobago on three occasions in connection with the management of Tobago Farm.

Mr. W. G. Freeman sailed for Canada on three months leave, by s.s. "Chaudiere," on September 5.

Mr. J. Jonggrijp, Forest Officer of Suriname spent two weeks in Trinidad the latter part of October. He accompanied Mr. Rogers on trips to the Arima and central range plantations.

Mr. Louis Seheult, B.Sc. has been appointed Acting Manager of River Estate during the absence of Mr. R. O'Connor who left to join the Army. Mr. Seheult began duty on October 13.

Mr. P. L. Guppy, in charge of Froghopper Investigation, left the Colony on leave by the "Mayaro."

Mr. J. de Verteuil, Superintendent of Field Experiments has obtained an extension of leave.

The Horticultural Club held a successful Flower and Fruit Exhibition at the Victoria Institute on October 23.

At a meeting of the Board of Agriculture on October 13, Mr. C. M. Roach was appointed as an Agricultural Inspector. Mr. Roach has served for eleven years on Verdant Vale Estate, Arima, at first as yard and building foreman and latterly as overseer.

Mr. J. B. Rorer left for Martinique on October 27, for a month's vacation in Martinique.

MARKET QUOTATIONS FOR LOCAL PRODUCTS, OCTOBER 12, 1915.

CACAO—Estates per 110 lbs. \$17.75 to \$18.25.

Ordinary „ \$17.50 to \$17.75.

COCONUTS—Standard per 1,000 \$22.00 to \$23.00.

Culls „ \$18.00 to \$14.00.

COPRA—per 100 lbs. \$3.80 to \$3.90.

COCONUT OIL—per Imperial gallon 75c.

COIR FIBRE—per 100 lbs. \$3.00.

CEDAR LOGS—10 ft. contents and up 50c.

CORN SHELLED—per bag of 110 lbs. net \$1.50.

MOLASSES, VACUUM—per wine gallon 5c. to 7c. as to quality.

PILOT BREAD—per barrel of 60 lbs. net \$3.00.

PIGEON PEAS—per 100 lbs. \$4.00.

RUM—per proof gallon 60c. to 65c.

SUGAR—White Crystal per 100 lbs. \$5.00.

Yellow Crystal „ \$4.50.

Molasses „ \$3.50 to \$3.75.

Indian Agricultural Research Institute (Pusa)
LIBRARY, NEW DELHI-110012

This book can be issued on or before

Return Date	Return Date